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PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR

1890.

TASMANIA:
PRINTED AT "THE MERCURY" OFFICE, MACQUARIE ST., HOBART.

1891.

The Responsibility of the Statements and Opinions given in the following Papers and Discussions rests with the individual Authors; the Society as a body merely places them on record.

ROYAL SOCIETY OF TASMANIA.

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Contents.

	Page.
Proposed Visit of Professor Huxley	I
Election of Four Members	I
Presentation of Encyclopædia Britannica	III
Sir Lambert Dobson's Remarks on the Gift of His Excellency to the Royal Society's Library	V
His Excellency in Reply	V
Australasian Association	V
Settlement of Northern Tasmania (a Paper)	VI
Ganoid Fish (a Paper)	VII
Marine Organisms	VII
Election of Four Members	VIII
The late Rev. J. E. Tennison-Woods	IX
Tasmanian Fishes (a Paper)	IX
Root Matters in Social and Economic Problems (a Paper)	X
Hop Plant (Daviesa latifolia)	XI
Foraminifera and Mollusca (a Paper)	XI
Disease in N. S. Wales Oysters	XI
Election New Member	XII
Records of Early Events	XII
Australasian Science Association	XII
Third Meeting of the Science Association	XII
The Moon and the Rainfall (a Paper)	XII
A Fossil Tree	XIV
Eucalyptus Risdoni, a variety	XV
Kea (Nestor Notabilis)	XV
Black Marble from the Gordon River	XV
New Member Elected	XVI
Native Stone Implements	XVII
Dredging Trip on the Derwent (a Paper)	XVII
Tasmanian Mollusca (a Paper)	XVIII
Coco-de-mer (Lodoicea Seychellarum)	XIX
New Member Elected	XX
Mr. Thomas Whitelegge Elected Corresponding Member	XX
Remarks on Mr. Wintle's Fossil Tree	XX
Antarctic Exploration (Letter)	XXI
Geological Observations on the West Coast (a Paper)	XXIV
New Tasmanian Fern (Blechnum Cartilagineum)	XXV
A Gum-tree Grub	XXV
Resolution *re* Antarctic Exploration	XXVI
The Last Antarctic Exploration (a Paper)	XXVII
What Science and Commerce may gain from an Antarctic Expedition (a Paper	XXVII
Strikes and Real Wages (a Paper)	XXVIII
Gift by Dr. Agnew, three vols. of H.M.S. "Challenger"	XXIX
Election of Four New Members	XXX
Mr. T. A. Urquhart Elected Corresponding Member	XXX
Tasman's Journal (a Paper)	XXXI
New Tasmanian Spiders	XXXI
Ostrich Farming (a Paper)	XXXI
Election of Two New Members	XXXII
Australasian Association's Fourth Meeting. Grant promised by Government, £500	XXXIII
Strikes and Wages (a Paper)	XXXIII
Actinomycosis and Tuberculosis (a Paper)	XXXIV
Coal Specimens, exhibited by Mr. C. Allport	XXXV
The President's Address	XXXV

PAPERS.

Page

ART. I.—Root Matters in Social and Economic Problems (2nd Series). By R. M. Johnston, F.L.S.... 1

ART. II.—Further Observations upon the Fishes and Fishing Industries of Tasmania, together with a Revised List of Indigenous Species. By R. M. Johnston, F.L.S.... 22

ART. III.—Do the Changes of the Moon Affect the Rainfall? By E. C. Nowell, Hon. Member R.S.S. 47

ART. IV.—Provisional Aid to the Study of the Tasmanian Mollusca. By R. M. Johnston, F.L.S.... 57

ART. V.—Description of a Second Ganoid Fish from the Lower Mesozoic Sandstones near Tinderbox Bay. By R. M. Johnston, F.L.S., and A. Morton, F.L.S.... 152

ART. VI.—The Discovery and Occupation of Port Dalrymple. By J. Backhouse Walker, F.R.G.S. 155

ART. VII.—Remarks on a Recent Proposal to Introduce Ostriches into Tasmania. By James Andrew 176

ART. VIII.—Notes on a Recent Dredging Trip in the Derwent. By A. Morton, F.L.S.... 185

ART. IX.—Notes on some Geological Observations on the West Coast. By A. Montgomery, M.A. 188

ART. X.—Observations on the Influence of Strikes upon Real Wages. By R. M. Johnston, F.L.S.... 196

ART. XI.—Can Strikes really Improve the Condition of the Masses? By A. J. Ogilvy 202

ART. XII.—General Increase of Wages Falls upon Consumers of Products, and in no way encroaches upon Rent or Profits of Capitalists. By R. M. Johnston, F.L.S. 208

ART. XIII.—Notes on a new Tasmanian Plant of the order Burmanniaceæ. By Baron von Mueller, K.C.M.G., etc. 232

ART. XIV.—New Species of Tasmanian Araniedæ. By A. T. Urquhart 236

ART. XV.—Notes on Actinomycosis and its Transmissibility to the Human Subject. By C. E. Barnard, M.D. 254

ART. XVI.—What Science and Commerce may Gain from an Antarctic Expedition. By A. Morton, F.L.S. 260

ART. XVII.—Description of a Fern (Blechnum Cartilagineum) new to the Tasmanian List. By R. M. Johnston, F.L.S. 263

ART. XVIII.—Tabular List indicating the local Habits and the General Distribution of all the known Ferns, Club Mosses, and Pillworts of Tasmania. By R. M. Johnston, F.L.S. 265

ART. XIX.—Notes on the localities mentioned in the Journal of Tasman's Discovery of Tasmania 269

ROYAL SOCIETY.

APRIL, 1890.

The inaugural meeting of the members of this Society for the session of 1890 was held on April 22nd at the Museum. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., took the chair, and there was a large attendance of Fellows, while the visitors included a number of ladies.

PROFESSOR HUXLEY.

The PRESIDENT, on taking the chair, said he was not going to depart from his usual custom of only inflicting one address on the Society at the close of the session by giving an address also at the opening, but there was a matter which he would like to see brought before the Council and members of the Society. They had seen from the telegraphic news from London that Professor Huxley was on his way to Australia. He was to stop at Teneriffe and thence go on to the Cape, coming on to Australia by one of the Shaw Savill steamers. If that were so Hobart would be the first point in Australia that Professor Huxley would visit, and he thought that the advent of so great a man of science ought to receive some recognition from the Society. He therefore suggested to the Council and Fellows that it was very desirable that on his arrival the Professor should be met with an address from the Society. He would do all he could to induce Professor Huxley to break his journey at Hobart and spend a few days in Tasmania. But even if the Professor was only here during the short time the vessel was in Hobart he still thought they might make arrangements to invite him to the rooms of the Society to receive an address from the Fellows, which he (the President) would be glad to present. (Applause).

Mr. Alexander Durrand, F.R.M.S., was introduced as a visitor.

NEW FELLOWS.

Rev. E. H. T. Thompson, Messrs. A. W. Gosnell, M.A., and Robert Shirley Hales were admitted Fellows of the Society.

ADDITIONS TO LIBRARY.

The Secretary, Mr. A. MORTON, read the following list of additions to the Library of the Royal Society :—

Adelaide University Calendar for the Academical Year 1890 (bound). From the Council.

Anales de la Oficina Meteorologica Argentina, Tomo VII. From the Department.

Anales del Ministerio de Fomento de la Republica Mexicana. From the Society.

Annales de la Société Royale Malacologique de Belgique. Current Nos. From the Society.

Annual Progress Report of the Geological Survey for the year 1888-9, Queensland. From the Government Geologist.

Anzeirger der Kaiserlichen Akademie der Wissenschaften Mathematisch Naturwissenschaftliche Classe XXV., 1888. From the Society.

Astronomische Arbeiten des K. K. Gradmessungs-Bureau, 1, Band. From the Society.

Athenæum. Current Nos.

Boletin Mensual del Observatoria Meteorologico del Colegio Pio de Villa. Colon Montevideo. From the Society.

Boletin Mensual, Tomo II., No. 34. Mexico. From the Society.

Boletim da Sociedade de Geographia de Lisboa. Current Nos. From the Society.

Bollettino della Societa Geografica Italiana, Serie 3, Vol. II., III., 1889, 1890. From the Society.

Bollettino dei Musei di Zoologia ed Anatomia Comparata, Vol. IV., 1889. From the Society.

Botany Bay, or Eucalyptus "Kino" (pamphlet). By J. H. Maiden, F.L.S. From the Author.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass., Vol. XVI., No. 6, Geological Series. The intrusive and extrusive Triassic trap sheets of the Connecticut Valley. By W. M. Davies and C. L. Whittle, Vol. XVIII., No. 5. The Morphology of the Cartoids. By F. Ayers, No. 6. Cave Animals from Western Missouri. By S. Garman. Annual Report for 1889. From Professor Agassiz.

Bulletin de la Société Imperiale des Naturalistes de Moscow, current Nos. From the Society.

Bulletin de la Société Royale de Botanique de Belgique Tome Vingt-Huiteme. Bruxelles, 1889.

Catalogue of Fossil Reptilia and Amphibia, part III., 1889. From the Trustees British Museum.

Contributions to Canadian Palæontology, Vol. I., by J. Whiteaves, F.G.S., "On some fossils from the Hamilton formation of Ontario, with a list of the species at present known from that formation and province." The fossils of the Triassic Rocks of British Columbia. On some Cretaceous Fossils from British Columbia, the N.W. Territory, and Manitoba. From the Department.

Department of Agriculture of Victoria, Bulletin June, 1888. Bulletin 3, 4, 5, April, July, and September, 1889. From the Department.

Department of Agriculture, Queensland—Report of the Government scientific expedition to Bellenden—Ker Range upon the Flora and Fauna of that part of the colony. From the Department.

Department of Mines, Sydney, N.S.W. Records of the Geological Survey of N.S.W., Vol. 1; Parts I., II., III., 1889. Palæontology—No. 1. The invertebrate fauna of the Hawkesbury. Winamatta series, beds above the productive, coal measures of N.S.W. By R. Etheridge, junr. Mineral products of N.S.W. By Harrie Wood. Notes on the Geology of N.S.W. By C. S. Wilkinson. Description of the Seams of Coal worked in N.S.W. By J. Mackenzie. Geology of the Vegetable Creek Tin-Mining Field, New England District, N.S.W., with maps and sections. By T. W. E. David. Contribution to the Tertiary Flora of Australia. By Dr. C. Baron von Ettingshausen. Annual Report of the Department of Mines for the year 1888. From the Department.

Department of Agriculture United States (Division of Entomology). Insect Life. Vol. I., Nos. 1 to 12, 1889, devoted to the Economy and Life Habits of Insects, especially in their relations to agriculture, and edited by the Entomologist and sanction of the Commissioner of Agriculture. Nos. 1 to 6, 1889. Bulletin No. 16. The Entomological Writings of Dr. A. S. Packard. By S. Henshaw. 1887. Bulletin No. 18. The Life and Entomological Work of the late Townend Glover, first Entomologist to U.S. Dept. of Agriculture. By C. R. Dodge. 1887, Bulletin 19. An examination of the published synopsis catalogues and lists of N.A. insects, together with other information intended to assist the student of American Entomology, 1888. Bulletin 20. The Root Knot disease of the peach, orange, and other plants in Florida due to the

work of Angullura, prepared under the direction of the Entomologist, J. C. Keal. Bulletin No. 9. The Mulberry Silkworm; being a manual of instructions in silk culture. By C. V. Riley. No. 10. Our Shade Trees and their insect defoliators; being a consideration of the four most injurious species which affect the trees of the capital, with means of destroying them. By C. V. Riley. No. 11. Reports of experiments with various insectide substances, chiefly upon insects affecting garden crops. No. 13. Reports of observations and experiments on the practical work of the division made under the direction of the Entomologist, 187. No 14. Do. do. No. 15. The Icerya or Fluted Scale, otherwise known as the Cottony Cushion Scale. Catalogue of the exhibit of Economic Entomology at the World's Industrial and Cotton Centennial Exhibition, New Orleans, 1884-5. No. 6. General Index and supplement to the nine reports on the insects of Missouri. By C. V. Riley, Washington, 1881. Third report of the U.S. Entomological Commission, relating to the Rocky Mountain Locust, the Western Cricket, the Army worm, Canker worm, the Hessian fly, together with descriptions of Larvæ of injurious forest insects. Studies on the embryological development of the locusts and of other insects, and on the systematic position of the orthoptera in relation to other order of insects. Four reports of the U.S. Entomological Commission; being a revised edition of Bulletin No. 3, and the final report on the Cotton worm, together with a chapter on the Bollworm. By C. V. Riley. Maps and Illustrations. From the Entomologist.

Encyclopædia Britannica, a dictionary of arts, sciences, and general literature (ninth edition), Vols. 1 to 24, with index. From His Excellency Sir R. G. C. Hamilton, K.C.B.

Estudio de la Filosofia y Riqueza de la Lengua Mexicana par el presb AJastina de la Rosa. From the Department.

Geological and Natural History and Survey of Canada, A. R. C. Selwyn, LL.D., Director. Vol. I., pp. 11. Contributions to Canadian Palæontology. By J. F. Whiteaves, F.G.S. Contributions to the Micro Palæontology of the Cambria silurian rocks of Canada, pt. II. By E. O. Ulrich. From the Department.

Guide to the Mineral Gallery, British Museum. From the Trustees.

Guide to the study of insects and a treaty on those injurious and beneficial to crops, for the use of colleges, farms, and agriculturists, with 15 plates and 670 woodcuts. By A. S. Packard, New York, 1889, (Bound).

Hepatic, A new British. By A. H. Pearson. From the Author.

Illustrations of typical specimens of Lepidoptera, Heterocerca collection in the British Museum, Vol. VIII. By A. G. Butler. Illustrated (bound). From the Trustees.

Jahrbuch des Norwegischen Meteorologischen, Instituts, 1885-6. From the Department.

Journals and proceedings of the Royal Society of New South Wales, Vol. XXIII., 1889, report 1. From the Society.

Journal of Morphology, Vol. III. From the Editor.

Journal of the Royal Microscopical Society. Current Nos. From the Society.

Lichen Flora of Queensland with description of species. By J. Shirley. From the author.

List of named Insects in the South Australian Museum, Adelaide. By J. G. O. Tepper, F.L.S. From the author.

Meteorological Service, Dominion of Canada. Monthly weather Review. Current Nos. From the Department.

Meteorologische Beobachtungen Moscow. From the Department.

Monograph of the Horny Sponges of Australia. By Dr. Lendenfeld. Illustrated (bound). From the Trustees Sydney Museum.

Monthly notices of the Royal Astronomical Society (current numbers). From the Society.

Monthly Weather Review of the United States (current numbers). From the Department.

Monthly records of results of observations in Meteorological, Terrestrial Magnetism, etc., taken at Melbourne during October and March, 1889. From the Department.

Nature. Current Nos.

Nouveaux memoires de la Societe Imperiale des Naturalistes de Moscow, Tome XV. From the Society.

On Lighting and Gundpowder Magazine. On the Theory of Hail (pamphlets). From Mrs. Davies.

Perak Government Gazette. From the Government.

Proces-verbaux de la Seances Societe Royale Malacologique de Belgique. 1888-9. From the Society.

Proceedings of the Canadian Institute, Toronto, October, 1889. From the Society.

Prodromus of the Zoology of Victoria. Decade XIX. From the Government.

Psyche, a journal of Entomology, Comb., Mass. From the Society.

Proceedings of the Linnean Society of New South Wales (second series). Vol. IV. Pts. 1, 2, 3, 4. 1889. From the Society.

Records of the Australian Museum, edited by the Curator, Vol. I., No. 1, March, 1890. From the Department.

Records of the Geological Survey of India, Vol. XXII., pt. 4, 1889. From the Department.

Report of the first meeting of the Australasian Association for the Advancement of Science, held at New South Wales in August and September, 1888 (bound). From the Association.

Report of the Surgeon-General of the Army, U.S., June, 1889. From the Department.

Report of Mr. Tebutt's Observatory, N.S.W., for the year 1889. By J. Tebutt. From the Author.

Revue des Deus mondes, December 1, 1889. From the Society.

Revista do Observatorio Publico Mensal Imperial do Observatorio do Rio de Janeiro, Amion IV., 1889. From the Society.

Scottish Geographical Magazine, current Nos. From the Society.

Societé de Géographie de Lisbonne L'Incident. Anglo-Portugais motion Votée a la Seance de la Sociète de Geographie de Lisbonne. Le 2 Decembre, 1889. Impotation abusive en Afrique par des subjets Anglais D'Armes Perfectionne. From the Society.

Statistics of the Colony of Tasmania for the year 1888. From the Government.

Transactions and Proceedings and Report of the Royal Societv South Australia. Vol. XII., for 1888-9. From the Society.

Transactions of the Geological Society of Australasia. Vol. 1, . IV. From the Society.

Transactions of the Royal Society of Canada for the year 1888. Vol. VI. From the Society.

Transactions of the Wagner Free Institute of Science of Philadelphia. Vol. 2. From the Soceity.

United States Coast and Geodetic Survey Report of the Superintendent, showing the progress of the work during the fiscal year ending with June, 1887. Part I., Texts ; Part II., Sketches. From the Department.

Verhandlungen der Gesellschaft Fur Erdkunde zu Berlin. Band XVI., XVII., No. 9. From the Society.

Victorian Year Book for 1888-9, Vol. I. From the Government Statist.

Victorian Naturalist, The. Current Nos. From the Society.

Walch's Catalogue of Books for 1890. From the Publishers.

SIR LAMBERT DOBSON thought that they could hardly allow the list of additions to pass without calling special attention to the valuable addition made to the library by the presentation of the ninth edition of the "Encyclopædia Britannica" by His Excellency. This was a very grand and noble work, a veritable storehouse of knowledge, and treating of almost every possible subject in articles supplied by the greatest specialists of the day. He would not move a formal vote of thanks, as His Excellency was in the chair, but he was sure he spoke the unanimous feeling of the Society when he said that they all cordially appreciated the gift of His Excellency. (Applause.)

HIS EXCELLENCY, who was received with applause, said that the discovery of the existence of a Royal Society in vigorous operation was one of the many pleasant surprises he met in coming to Tasmania, and he made up his mind to do all he could to advance its objects, and as time went on to mark his appreciation of the work of the Society in a tangible and useful way. He had himself found in considering some of the subjects brought forward by the Society the want of ready access to some comprehensive and authoritative work of reference, and it seemed to him that the want must be felt by others. He therefore determined to present the Society with the best and most comprehensive work of reference, and it gave him much gratification to find that the addition to the library had met with acceptance. (Applause.)

AUSTRALASIAN ASSOCIATION.

Mr. JAMES BARNARD, Vice-President of the Society, said: Following the course which I took on the occasion of my return from attending the first meeting of the Australasian Association for the Advancement of Science, which was held in Sydney in 1888, when I gave a short personal explanation of what had occurred, I now ask permission to state in a few words the particulars of the second annual meeting of the Association, which was held in Melbourne in January last. As is known to the Fellows, several other gentlemen representing our Royal Society were associated with me in this visit to Melbourne, and I venture to in some measure speak their sentiments as well as my own when I bear testimony to the warmth and cordiality of the welcome accorded to us in Melbourne from the moment of our arrival until our departure. Throughout our stay we were most hospitably entertained with free quarters by Dr. Leeper at Trinity College in the University, besides sharing in a variety of entertainments and concerts given generally to the members of the Association by the distinguished President, Baron Von Müeller, K.C.B., the Hon. Sir William Clarke, Bart., the Worshipful the Mayor of Melbourne and others. Excursions and visits to places of attraction were also planned and provided for, and were more or less availed of. I need not speak of the part which my colleagues and myself took in the work of the several sections of the Association, as that will be shown in the annual volume recording its transactions. Suffice it to say that the sittings of the various sections were assiduously attended by our little Tasmanian band. During the session Tasmania came well to the front, and the proposal to hold the fourth annual meeting of the Association at Hobart in 1892, instead of at Adelaide, received general support, and was carried by acclamation. Hence it is suggested that a corresponding obligation is now imposed upon the Council and Fellows of the Royal Society of Tasmania, aided by the willing co-operation of all having sympathy with the object, to form themselves into a committee to consider the proper steps to be taken for holding the meeting of the Association in Hobart at the date fixed; nor is it much too soon to open a subscription-list and invite for it liberal support; for while it is neither expected nor desired that Tasmania, with its limited means, should attempt to vie

with Melbourne or Sydney, with their magnificent resources, still the expenses incidental to the honour of the position, and the call to reciprocate in some degree the attentions shown to the Tasmanian representatives in the colonies mentioned, must necessarily be considerable. It may also be mentioned, in conclusion, as a good omen of success, that our painstaking and energetic secretary, Mr. Alexander Morton, has accepted the position of local honorary secretary for the occasion; and a general desire was expressed that our own highly-esteemed president, His Excellency Sir Robert Hamilton, would consent to officiate as president of the Association for its meeting in Hobart in 1892. (Applause).

THE SETTLEMENT OF NORTHERN TASMANIA.

Mr. J. B. WALKER read a paper on "The Discovery and Occupation of Port Dalrymple." The writer began by remarking that the discovery of Southern Tasmania belonged to the ancient epoch of Australian history, but the discovery of Northern Tasmania to the modern period 150 years later, when Port Jackson had already been settled. The exploration of Bass Straits and of Port Dalrymple was the work of Bass and Flinders. A sketch of the daring voyage of Bass from Sydney to Western Port in an open boat, and of the discovery of Port Dalrymple and circumnavigation of Tasmania by Flinders and Bass in the little 25-ton sloop Norfolk in 1798, followed. The northern settlement was made by order of Lord Hobart, Secretary of State for the Colonies, for political reasons, to prevent the French getting a footing in Bass Straits. Colonel Paterson was appointed Lieut.-Governor of the New Settlement, and left Port Jackson on June 7, 1804, with 20 convicts and a guard of 20 soldiers. The ships were driven back by gales, but in October following a new attempt was made, and this time was successful. H.M.S. Buffalo, assisted by the schooners Integrity and Francis, and the armed tender Lady Nelson conveyed the expedition, which consisted of 67 military, under the command of Capt. Anthony Fenn Kemp and 74 convicts. Dr. Mountgarrett was surgeon, and Mr. Alex. Reilly storekeeper. The vessels were separated by a gale on the voyage down, and the Buffalo on entering the River Tamar ran aground near Outer Cove (George Town). The prisoners and stores were accordingly landed there on November 10, 1804, and formal possession was taken the next day. Huts were erected at Outer Cove, and the settlement established there, while Lieut. Governor Paterson went up the river to examine the country. He went up the North Esk some miles in his boat, and considered the country better than any that had been up to that time discovered, either in Van Diemen's Land or New South Wales. On his return, however, he chose, as his headquarters, a site at the head of the shallow inlet of Western Arm where the land was bad. Mr. Walker thought that Paterson's reasons for what seemed such an extraordinary choice were to be sought in the policy of the Home Government whose object was to establish military posts near the entrances of harbours to be maintained by convict labour, and not to found colonies in the modern sense. In March 1805, Paterson moved his headquarters to the new site, which he named York Town, but still retained the settlement at Outer Cove (George Town.) At this time the colony contained about 200 people, afterwards increased to 300. After about 12 months York Town was found so unsuitable that Paterson in March 1806, removed his headquarters to the banks of the North Esk, on the present site of Launceston. York Town was not finally abandoned until a year later. The site of this early settlement is about five miles north-west of Beaconsfield, at the head of Western Arm, nearly opposite to George Town. No remains exist of the buildings erected by Lieut-Governor Paterson in 1804.

A GANOID FISH.

The next paper, which was read by Mr. R. M. Johnston, was a description by that gentleman in conjunction with Mr. A. Morton, of a second ganoid fish from the lower mesozoic sandstones, near Tinder-Box Bay. Last session the same gentlemen brought under the notice of the Society a similar fish, obtained from the Knocklofty sandstones, and named *Acrolepis Hamiltoni*, in honour of the President, Sir Robert Hamilton. The present specimen is much better preserved, and although closely allied to the first is yet distinct in several respects. Some good photographs of the specimen were shown, and the writers expressed their belief that there was a probability of a larger number of these interesting fish remains being obtained when operations in certain quarries were again carried out. He mentioned as an interesting fact that a fish of similar species had been recently found at Latrobe.

MARINE ORGANISMS.

Mr. A. Durrand, Fellow of the Royal Microscopical Society, London, exhibited a select series of microscopical preparations of foraminifera and other minute marine organisms from soundings made at depths from five fathoms to about two miles among the islands of the Hawaiian Group, Coast of Java, Channel Islands (Guernsey), Ireland, etc., demonstrating the important part which the calcareous and siliceous remains of these organisms play in submarine deposits, which after upheaval and solidification, constitute a material portion of limestone and similar formations, the city of Richmond, United States, America, being built on an ancient sea bed covering a considerable area, many feet in depth, and largely composed of the inorganic remains of these tiny denizens of the deep, the beauty of which is indescribable by pen or pencil. Some of the specimens shown were from a fossil deposit over 60ft. thick at Wanganui, New Zealand, and appeared as perfect as those recently alive. In connection with this he stated that Mr. Morton, Secretary of the Society, and he (Mr. Durrand), purposed conducting dredging operations in the harbour to ascertain the distribution of these interesting forms, the result of which will probably be submitted to the Society during his stay, and as the microscopical life of our harbour may present some unique features, being yet comparatively unexplored, the investigations of Messrs. Morton and Durrand are expected to result in important information in this direction.

CONGRATULATORY.

The PRESIDENT moved a vote of thanks to the gentlemen who had contributed papers, and mentioned as a matter for congratulation that for the first time the printed proceedings of the past session were on the table at the opening of a new session.

The proceedings terminated.

MAY, 1890.

The monthly meeting of this Society was held at the Museum on Tuesday, May 20th, the President, His Excellency Sir Robert G. C. Hamilton, K.C.B., took the chair.

NEW MEMBERS.

The following gentlemen were elected Fellows :—Messrs. A. B. Howell, J. W. Beattie, Alfred T. Bell, and H. Foster.

THE LIBRARY.

The Secretary, Mr. A. MORTON, submitted the following list of additions to the Library during the month of April :—

Bollettino della Societa Geografica Italiana, Fasciolo II., February and March, 1890. From the Society.

Boletin Mensual del Observatorio, Meteorológico del Colegio Pio de Villa Colon. From the Department.

Boletin del Instituto Geografica Argentino, Tomo X Cuad X Bueno Aires. From the Society.

Flora of British India. Pt. XVI. By Sir J. D. Hooker. From the Department.

Geological and Natural History Survey of Canada, Alfred R. C. Selwyn, C.M.G., etc., Director. Annual Reports (new series). Vol. III., pt. I. Reports, A.B.C.D.E.F., 1887-8, pt. II. Reports, H.J.K.L.M.N.R.S.T., 1887-8. Maps, etc., to accompany Annual Reports, Vol. III., 1887-8. From the Department.

Handbook of cyclone storms in the Bay of Bengal, for the use of sailors. By J. Eliot, M.A. From the Meteorlogical Department.

Horsburgh's East India Pilot, containing a number of old Charts, London 1817, also Table des Cartes et Plans, contenus dans L'Atlas du voyage aux Terres Australis, 1801 to 1808. From the Hon. Attorney General.

Journal of the Royal Horticultural Society of London, Vol. XI., part III., October, 1888. From the Society.

Kongl. Svenska Velenskaps—Akademiens Handlingar Bandet 23, No. 3. Species Sargassorum Australiæ, Descriptœ et Dispositæ accedunt de Singulis Partibus. Sargassorum Earumque Differentiis Morphologicis in diversis speciebus observationes nonnullæ, nec non dispositionis specierum omnium generis his differentiis Fundatœ, Periculum, Auctore J. G. Agardh, cum XXXI., Tabulis. From the Society.

Memoirs of the Museum of Comparative Zoology, Cambridge, Mass. Vol. XVII. No. 1. The immature state of the Odonata. Pt. III. Sub-family Cordulina. By Louis Cabot. (Plates.) From A. Agassiz.

Memoirs of the Geological Survey of India, Palæontologica Indica, being figures and descriptions of the organic remains procured during the progress of the Geological Survey of India. Ser. XIII. Salt Range Fossils. Vol. IV., pt. I. Geological Results. By W. Waagen, Ph. D. From the Department.

Monthly Weather Review, Meteorological Service Dominion of Canada. (Current Nos.) From the Department.

Monthly Weather Review, U.S. War Department. (Current Nos.) From the Department.

Monthly notices of the Royal Astronomical Society, Vol. L., No. 4, February, 1890. From the Society.

Report on the worm disease affecting the oysters on the coast of N.S.W., by T. Whitelegge, F.R.M.S., April, 1890. From the Fisheries Department.

Revista do Observatorio Publicacao mensal de Observatorio do Rio de Janeiro, Anno V., Jan. de 1890, N. 1. From the Department.

Scottish Geographical Magazine, current Nos. From the Society.

United States Department of Agriculture (Division of Entomology), Vol. ii., Nos. 7, 8 and 9. Insect Life. January, February, March, 1890. Bulletin No. 21, Report of a trip to Australia, made under the direction of the Entomologist to investigate the natural enemies of the Fluted scale, by Albert Koebele. From the Department.

Victorian Year Book for 1888-89. From the Government Statist.

Tasmanian Official Record, 1889. By R. M. Johnston, F.R.S. From the author.

Transactions of the Royal Society of Victoria. Vol 1, Pt. ii. From the Society.

Transactions of the Seismological Society of Japan. Vol. xiv. From the Society.

THE LATE REV. J. E TENISON-WOODS.

Mr. R. M. JOHNSTON referred to a proposal to erect a memorial tombstone over the grave of the late Rev. J. E. Tenison-Woods, as a small tribute of respect to one who has done much for the good of religion and science, and also for the colonists generally, in whose interest he sacrificed his valuable lite. He said he had been associated with the deceased for many years, and derived the greatest benefit from him in many branches of science. He was in sympathy with all fellow-workers throughout the Australias, and it was hoped the object would be successful. He placed a subscription list on the table in order that members who desired might contribute.

TASMANIAN FISHES.

Mr. R. M. JOHNSTON, F.L.S., read a paper, entitled, "Further observations upon the fishes and fishing industries of Tasmania, together with a revised list of indigenous species." Eight years ago he contributed a similar paper, and since that time Messrs. Alex. Morton and Saville Kent have added two or three interesting papers on the same subject. By this means the 188 species then known have increased to 214. After giving a complete list of the fishes Mr. Johnston dealt with the fishing industry, estimating that there are about 86 boats and 175 men engaged therein. Although it is estimated that, exclusive of the whaling trade, there are 1,005 persons directly depending upon the local fisheries, fully 63 per cent. of the men and boats belong to Hobart, and the men carry on their vocation either in the numerous sheltered indentations or bays in the upper or lower waters of the estuary of the Derwent, or in the exposed open sea between Seymour on the north-east and Port Davey on the south-west. The fishing carried on elsewhere, with the exception of the purely river fishing of the Tamar, is very limited, generally engaged in at odd times by persons who do not devote themselves exclusively to the fishing industry. The Tamar boats are not suited for fishing in the open sea of Bass Straits. With the exception of three or four decked smacks, the most of the boats employed in the waters of the Derwent, or in the open sea trumpeter and Barracouta fishing-grounds, are mere open centre-board whaleboats, fitted with fish-wells perforated in direct communication with the sea, and designed to keep the fish alive until sold in the open market in the Fisherman's Dock, Hobart (salt water.) The trumpeter and other fish will feed in such confinement, and the former has been known to live healthily in this way for a period of three months. The average value of one of these excellent sea-boats is (generally about 37ft. 6in. long; beam, 7ft. 8in.; depth, about 3ft.) about £100, and the equipment, in the shape of nets and deep sea lines, say £20; in all, say £120 for each boat. There are usually three men to each boat. Even with a small crew of this kind, as much as 40 dozen kingfish, weighing 12 to 14lb. each, have been caught in a

single night when the fish have been plentiful. Barracouta can be captured in large quantities during the season—January to June. About 24 dozen Barracouta weigh a ton. The fishermen state that, could they be assured of a market, 3s. a dozen for barracouta or kingfish would amply repay them—*i.e.*, about ¼d. a pound. The average quantity of trumpeter, perch, trevally, barracouta, kingfish, conger eel, and crayfish, exported each year, almost wholly to Victoria, amounts to 3,396doz. The average price of the trumpeter is fixed at 1s. per lb., and he estimates that the yearly sales of fish since the decline of the oyster fishery do not exceed £10,000 per annum. The decline in the value of oil obtained from the whale fishery is shown by comparing the first and second quinquennium, the first yielding £31,281 worth, and the second £19,223 worth.

ROOT MATTERS IN SOCIAL AND ECONOMIC PROBLEMS.

Mr. R. M. JOHNSTON, F.L.S., continued his study of root matters in social and economic problems by reading a paper on that head. This contribution formed the second series, and follows the able paper read by him during last session. In that he dealt exhaustively with almost every branch of social and economic science, and in the paper read last night he treated the same subjects under the following heads:—"Natural Limits to the numbers engaged in various occupations;" "Dominating wants determine occupations, and necessarily produce inequalities in the form of services;" "Utopian scheme of socialists;" "What should be the probable effect upon social well-being if the major source of savings were destroyed;" "Anterior savings the true source of capital invested in the creation and distribution of necessary satisfactions;" "Fallacies of the single tax proposal." To give a clear example of the difficulties that are here to be met with by workers he introduces a fictitious deputation from the shoemakers driven out of employment by competition with cheap foreign manufactures, and employs a theorist to represent the Government and argue the question with him.

Mr. A. J. TAYLOR thought that one of the principal values of the papers read by Mr. Johnston consisted in the fact that they drew attention very positively to the fact that in writing and dilating upon the social problems occupying our attention we were apt to lose sight of the deeper considerations that underlie the superficial consideration often given to those questions. Mr. Johnston gave an illustration of this in his last paper, when in speaking of protection and freetrade, he called attention to the fact that we were apt, in dealing with the subject, to regard those important questions as ends rather than as means to an end, that end being to secure the maximum of comfort essential to living a healthy and happy life at a minimum cost of labour. He referred briefly to several of the subjects alluded to in the paper, and considered such contributions valuable, as showing the people that many economic questions have not yet been settled, and have still to be faced.

His EXCELLENCY said:—"A paper like that read to us to-night by Mr. Johnston requires to be studied carefully before discussing it, and I do not wish to enter into discussion with Mr. Johnston, for although some of the propositions he has raised are in their essence rather economic than political, yet the question of protection of native industries has, in these colonies, a political and party bearing which makes it undesirable that I, as Governor, should take part in discussing them. But there is one root matter in connection with economic problems bearing directly upon this point to which I do not think Mr. Johnston has sufficiently called attention, and it is this, that all commerce is barter, and that if we import foreign goods, either shoes or anything else, we export something in exchange for them, and if we cease to import such goods, we

necessarily interfere with the production of the native goods which we exported to pay for them. I do not for a moment suppose that Mr. Johnston would dispute this root matter, and I am sure he will not feel annoyed at my pointing out that in my view it deserves more attention at his hands than it has received in this paper." He moved a vote of thanks to Mr. Johnston for his papers, which was passed.

HOP PLANT.

Mr. ALFRED J. TAYLOR called attention to a specimen of the native hop (*Daviesa latifolia*). This shrub was to be found on all the stony ridges and barren bush lands of the colony. He had been assured that some remarkable cures of hydatids had been effected in Victoria by the administration of an infusion made from the leaves of this plant. Perhaps the Government Analyst would kindly prepare some notes on the plant for some future meeting of the Society. He also showed two interesting illustrations of homes made without hands in peculiar formations of gum leaves.

FORAMINIFERA AND MOLLUSCA.

Mr. MORTON drew attention to a recent dredging trip in the harbour, and regretted that Mr. Durrand, who was introduced at the last meeting, was unable to be present to submit a microscopical slide containing some very interesting examples of various forms of foraminifera that he had mounted for the inspection of the Fellows. The result of the dredging trip was of importance, as the forms obtained resembled the marine fauna of Port Jackson, and the results of a few dredging trips intended during the season would no doubt prove very interesting. Among the specimens dredged were a large number of mussels, and each contained a small crab, which on examination appeared to belong to the genus Fabia. It was rather interesting to learn from some of the old residents that many years back, when mussels were numerous as at present, in the majority of cases every mussel contained a crab similar to those exhibited, and that the oysters, while mussels were in large quantities, were few. Some time afterwards the mussel became nearly extinct, while the oyster multiplied. Whether that was due to this parasitical crab or not he was unable to say, but the fact was singular that while the crab was now noticeable in the mussel the oyster was increasing in numbers. Whether history would repeat itself it would be difficult to say, but it would be interesting to observe the result. In conjunction with Mr. Durrand he intended at next meeting to submit a paper on the results of the dredging of the harbour.

Sir LAMBERT DOBSON recollected that many years ago, when mussels were plentiful, they were destroyed by a little red crab. For many years there were no mussels, now they were again plentiful.

Mr. R. M. JOHNSTON said he had noticed as a remarkable coincidence that the disappearance of the mussel in former years was followed by the increase of the oyster, and the decrease of the oyster meant the increase of the mussel. It was desirable to know the cause of this phenomenon, and he hoped Mr. Morton would pursue his investigations in regard to those molluscs and their enemies.

Mr. MORTON said that he had had forwarded to him, by the Fisheries Commission of New South Wales, a most valuable paper prepared by Mr. Thos. Whitelegge, F.R.M.S., Zoologist to the Sydney Museum, on the disease observed in the oysters on the New South Wales coast. As the question of introducing the Sydney oyster on the Tasmanian coast occupied the attention of the Fisheries Board at present, he intended to submit some extracts from Mr. Whitelegge's valuable paper at next meeting of the Society.

The PRESIDENT moved a vote of thanks to Mr. Johnston for his valuable papers.

The proceedings then terminated.

JUNE, 1890.

The monthly meeting of the Royal Society was held on Wednesday, June 11th, at the Museum. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., took the chair.

NEW MEMBER.

Mr. M. W. Simmons, solicitor, was elected a Fellow of the Society.

RECORDS OF EARLY EVENTS.

Mr. MORTON read a letter from Mr. A. B. Biggs, Launceston, suggesting that something be done by the Society in collecting records of early events in the history of the colony from the few surviving old colonists, as they were rapidly passing to the majority, and the opportunity would soon be for ever lost. The letter was referred to the consideration of Mr. J. B. Walker, who is interesting himself in the ancient history of the colony.

AUSTRALASIAN SCIENCE ASSOCIATION.

Mr. MORTON submitted programme of the third annual meeting of the Australasian Association for the Advancement of Science, which will commence on Thursday, January 15, 1891, at Christchurch, New Zealand.

His EXCELLENCY asked if any of the members of the Society were going take to part in the proceedings.

Mr. MORTON said he believed that several members had forwarded their names to New Zealand.

THE MOON AND THE RAINFALL.

Mr. E. C. NOWELL, hon. member Royal Statistical Society, read a paper entitled "Do the changes of the moon affect the rainfall?" He said that the idea that the changes of the moon affected the rainfall had widely prevailed from the earliest ages. Traces of it were found in the Roman poet Virgil, while ages before the Babylonian Government Astronomers in their daily reports inserted many entries respecting the supposed influence of the heavenly bodies on the weather. Sailors especially were great believers in the influence of the moon on the weather, and the writer believed that it would be found that where ideas have become deeply rooted and widely spread, it is very seldom, if ever, that they have not some foundation in fact. The public, however, were assured by those whose opinions on such subjects carry great weight, that the popular notion was a mere delusion, and that the moon's changes had no influence on the weather. He quoted as scientific authorities on this point, Dr. R. J. Mann, vice-president of the Meteorological Society, Dr. Lardner, and Dr. Ball, Royal Astronomer of Ireland. Seeing that the statements of scientific men were at variance with the popular opinion, he resolved to investigate the matter for himself, and accordingly in 1880 he commenced to keep a meteorological journal in a rough way, and had continued it up to the present time. The results of the 10 years' observations were set forth in tabulated form, and so far as the inquiries on the subject warranted a conclusion, the only thing that could with safety be asserted was, "That there is a greater probability of having rain on the first than on any succeeding day of any of the moon's changes. He hoped the results submitted would be of some value as a contribution towards the investigation of an obscure but highly interesting subject, and also in stimulating further researches in this direction, in order to discover, if possible, what are the exact nature and limits of the influence exerted

upon the earth and its inhabitants by the moon and the remoter planets —the lesser forces—as well as by the great central source of power—the sun itself.

Captain SHORTT read a brief paper, criticising Mr. Nowell's views, in which he contended that it was not to the moon's influence alone that they should look for the effect stated, although he admitted that the moon was a great factor in the case. Though all parts of the world were not affected alike by the aspect of the sun, moon, and planets, he found that at Hobart under Jupiter and Mars' influence the temperature increased, and decreased with Saturn's; likewise the aspect of Saturn, Uranus, Venus, and Mercury produced rain and low temperature; also, that the aspect of the different planets produced more or less changes in the weather. It was also noticeable that after the tide turned to rise rain set in or fell heavier in rainy weather. Mr. Nowell, in his paper, had only notified the commencement of rain, and did not give the number of rainy days in each quarter. He submitted a calculation of rainy days for 1889, omitting those under three points, which showed that the greatest number of rainy days was on the fourth or middle day of the quarter. The results were set out in tabulated form, and showed that there were 61 days of one or two points of rain. This large number of rainfall he considered attributable to the proximity of the city to Mount Wellington, which attracted the low moist clouds, from which fell slight showers of rain.

Mr. C. H. GRANT thought it would be interesting to the Society and science generally if Capt. Shortt would give some detailed particulars of the way in which he arrived at the conclusions he had stated in regard to the planets affecting the weather, as those conclusions were not generally known or accepted. He would like also to remark, in regard to Mr. Nowell's paper, that the writer did not profess to be a scientist, and therefore his conclusions were not to be judged by the rigid rules of science. It seemed to him that he had amalgamated to a certain extent popular ideas with science, and that therefore all his conclusions must not be accepted as absolutely proved truths. In regard to lunatics for example, science had proved that there was not that affinity of the one with the other that he had indicated. They were indebted to Mr. Nowell for the trouble he had taken, and he hoped it would lead to the changes in the weather being more carefully noted. The near proximity of the city to Mount Wellington, he believed, affected the rainfall, and consequently he thought that the meteorological tables of Hobart could be said to have very little value as compared with parts of the colony less affected by the proximity of the Mountain.

Capt. SHORTT promised to read a paper on the influence of the planets on the weather before the end of the session. (Hear, hear.)

Mr. NOWELL, in reply, said it was impossible for him to deal fully with Captain Shortt's criticisms without having an opportunity to peruse his paper, but if the paper read had done nothing else, it had brought out a most interesting statement from Captain Shortt, and the promise of an interesting paper. Captain Shortt had conducted his observations on a different system, but until he had a further opportunity of studying the matter he must adhere to his own system. Mr. Grant was inclined to think that the influence of the moon on lunatics was one of the popular ideas, but he thought it had been pretty well established by the officers of lunatic establishments, and might now be regarded not as one of the popular ideas, but as a scientific fact. Of course, as Mr. Grant said, he did not profess to be a scientist, but had rather treated the subject from a statistical point of view. They did not profess to be ultimate conclusions, but merely such as the facts seemed to warrant, and he would be glad if his paper was the means of causing the matter to be more accurately investigated. In regard to the situation of Hobart and its proximity to the Mountain, he had

guarded himself on this point by explaining that the observations were only intended to apply to Hobart, but he might say that Mr. Shoobridge told him that the rainfall at New Norfolk differed but slightly from that of Hobart, and suggested that he (Mr. Nowell) should take his observations. He considered, however, that he had better confine himself to Hobart, but never for an instant suggested that the conclusions derived from observations at Hobart would be generally applicable throughout the colony.

A FOSSIL TREE.

Mr. JAMES BARNARD read the following notes on a fossil tree found beneath 100ft. of basalt, at Richmond, Victoria, by S. H Wintle:—"In the early part of March last I received information to the effect that a fossil tree, 30ft. in length, had been brought to light by the workmen employed in the "bluestone" quarry of Messrs. Willis Brothers, at Richmond, Victoria. I immediately visited the spot, and found the bole of a tree lying in an east and west direction, partly embedded in a deposit of dark coloured sand. Portions of the trunk were in contact with the base of a basaltic flow 100ft. in thickness by measurement. The general opinion, before I examined it, among the uninitiated connected with the quarry, was that it was the common red gum of Victoria, *Eucalyptus rostrata*. I at once recognised it as belonging to an entirely different order, and if not a pine not very widely removed from it. Up to the present time, however, it has not been determined. I may, perhaps, venture to observe that in it I can see a close resemblance to *Salisburia* sp. (Mueller), which in several instances has been brought to light from under the basalt of the "deep leads" of Ballarat and elsewhere in Victoria. The tree is denuded of its branches; short stumps alone being left. This fact, coupled with the absence of twigs, leaf impressions, and seed vessels, and also the fine uniform character of the sand deposit, points to the tree having been carried to where it was found by aqueous drift agency. Although I requested the proprietors of the quarry to instruct their workmen to preserve anything in the vicinity of the tree which in the least might resemble nuts or cones, nothing in the shape of fossil fruit has been brought to light. I have been promised, however, that efforts will be made to disentomb the whole tree. The cracks and fissures of the ligneous tree are coated with minute iron pyrites; while the sand on which the tree immediately reposes is cemented to a considerable extent by the presence of the same mineral. For a depth of 4ft. from the base of the superimposed basalt, the deposit on which the tree rests may be described as an imperfect dirt bed, being charged with carbonaceous matter in a fine state of division. A well has been sunk in the compacted sand to a depth of several feet in order to catch the drainage from the joints and fissures in the basalt, but no rounded pebbles or gravel have been met with; nothing, in short, but fine drift sand, thus pointing to a depression that was filled up to a considerable extent by sand transported by aqueous agency prior to the outburst and overflow of the basaltic lava. The southern wall of the quarry is only 50yds., lineally, from the Yarra River. On the opposite bank the highly inclined Upper Silurian shales obtain, forming a precipitous bank in contradiction to a more or less gradually shelving bank wherever the basalt obtains. As the source of this newer pleistocene basalt had its origin, it is generally believed, at Heidelberg, some 10 miles distant, there is good ground for assuming that the Yarra River had not an existence at the period when the basaltic flow formed a crypt to the tree and sand bed; but that at a subsequent epoch it carved out its present channel, chiefly along the line formed by the contact of the basalt with the Silurian strata. It will be observed that the condition of the wood is that of more recent lignite, the fibres being very tough. I am strongly reminded by the occurrence of this tree beneath the basalt, and the physical change which has taken

place since it was deposited on its sandy bed, as well as by the existence of the Yarra River, of a similar change at a similar period at the site of the Geilston Bay freshwater limestone at Richmond, in Tasmania. A quarter of a century ago I published a popular description, under the title of "A Story of a Stone," of the great geological changes which had taken place since the traverting beds had been laid down by the eruption of basalt, and the subsequent formation of the River Derwent. The relation that the Yarra River bears to the fossil tree, its sand bed, and superimposed basaltic covering, is precisely the same as that which the Derwent River bears to the fossiliferous travertine deposits." Mr. BARNARD added that similar specimens had been presented to the Tasmanian Museum by his son, Dr. Barnard, while in New South Wales.

Mr. MORTON expressed regret at the absence of Mr. R. M. Johnston, owing to indisposition, as that gentleman was well acquainted with the subject, having largely referred to it in his "Geology of Tasmania."

Mr. C. H. GRANT said that the grain of the wood and general appearance of the specimens showed that the dioritic formation that poured out upon the trunk of the tree was at a lower temperature than was generally supposed.

SPECIMENS.

Mr. T. B. MOORE exhibited specimens of Eucalyptus, a variety of Risdoni, and a garnet stone from Collingwood Valley, West Coast.

Mr. MORTON exhibited two parrots, presented by Mr. F. Back, General Manager of the Government Railways. They are the Kea (*Nestor notabilis*), natives of New Zealand, and very destructive to sheep.

Mr. CURZON ALLPORT exhibited a specimen of black marble, taken from the mouth of the Gordon River, West Coast. Samples had been sent to London, and a company formed to work the same.

Mr. MORTON submitted specimens of ferns connected with limestone formations taken from the Chudleigh Caves.

On the motion of His EXCELLENCY, votes of thanks were passed to the gentlemen who contributed papers.

The proceedings terminated.

JULY, 1890.

The monthly meeting of the Royal Society was held at the Museum on Monday evening, July 14th. The President, His Excellency Sir R. G. C. Hamilton, K.C.B., presided.

NEW MEMBER.

Mr. Alexander Montgomery was elected a Fellow.

LIST OF ADDITIONS TO THE LIBRARY.

The following list of additions to the Royal Society's Library during the month of June were read :—

Acta Horti Petropolitani Tomus XI. Fascinlus 1.—From the Society.

Annual Report of the Department of Mines, New South Wales, for the year 1889.—From the Department.

Archives du Musée Teyler, Serie II., Vol. II., 1886; Vol. III., 1887; Serie II., Vol. III., 1889.—From the Department.

Boletin Mensual del Observatorio Meteorologico del Colegio Pio de Villa Colon, Montevideo. From the Society.

Bollettino della Societa Geografica Italiana. Serie III., Vol. III. Fasc. III. Mazo, 1890. From the Society.

Boletino del Instituto Geografico Argentino. Tomo X., Cuarderno X., XI., XII., Buenos Ayres. From the Society.

Boletino Mensual, Tomo II., No. 5, Mexico. From the Department.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A. Vol. XVI., No. 7. The Topography of Florida, by N. S. Shaler. No 8. On some occurrences of Ottrelite and Ilmenite Schist in New England, by J. E. Wolff. Vol. XIX., No. 1. Studies on Lepidosteus, part I., by E. L. Mark. No. 2. On the egg membranes and Micropyle of some Osseous fishes, by C. H. Eigenmann. No. 3. Reports on the results of dredging under the supervision of Alexander Agassiz in the Gulf of Mexico, 1877-8, etc. XXXII. Report on the Nudibranchs, by Rud. Bergh. From the Department.

Californian State Mining Bureau, Ninth Annual Report of the State Mineralogist for the year ending December 1, 1889.—From the Department.

Cyclone Memoirs Part II, Bay of Bengal Cyclone of August 21, 28, 1888.—From the Department.

Fondati on Teyler, Catalogue de la Bibliothéque, dressé par C. Ekama, Cinquieme, Livraison, Paleontologie, Geologie, Mineralogic Botanique, Zoologie, Géographiè, Costumes, Voyages pittoresques et Scientifiques.—From the Department.

Journal of the Royal Microscopical Society. Part 2, 1890. From the Society.

Los Agnas Minerales de Chile por el. Dr. L. Darapsky, Valparaiso. From the Society.

Monthly Record of Meteorological Observations for Victoria. From the Department.

Monthly Weather Review, Canada (current Nos.). From the Department.

Monthly Notices of the Royal Astronomical Society (current Nos.) From the Society.

Observatorio Nacioaal Argentino, vol. XI. Buenos Ayres. From the Department.

Perak *Government Gazette* (current Nos.) From the Government Secretary.

Proceedings of the Yorkshire Geological and Polytechnic Society (new series), vol. XI., part II., 1890. From the Society.

Scottish Geographical Magazine (Current Nos.) From the Society.

Synopsis of the Queensland Flora, containing both the Phænogamous and Gryptogamous Plants. By F. M. Bailey, F.L.S. From the Department.

Transactions of the Royal Geographical Society of Australasia (Victorian Branch). Pt. II. Vol. XII. From the Society.

Transactions and Proceedings of the New Zealand Institute, 1889. Vol. XXII. From Society.

Report, twenty-sixth annual, of the Zoological and Acclimatisation Society of Victoria for the year, 1889. From the Society.

Report, Sydney Free Public Library, for 1889-90. From the Trustees.

Report of the Wellington Acclimatisation Society, for nineteen months ending March 31, 1890. From the Society.

Revista do Observatorio, No. 4. Rio de Janeiro. From the Department.

Ver haudlunger der Gesellschaft. Für Erdkunde Zu Berlin. Current Nos. From the Society.

Victorian Naturalist. Vol. VII., No. 1. May, 1890. From the Society.

NATIVE STONE IMPLEMENTS.

Mr. MORTON read a letter which His Excellency had received from Mr. S. S. Rice, London, stating that his friend, Mr. E. B. Tyler, of the University Museum, Oxford, was anxious to procure some of the native stone implements of Tasmania, and asking His Excellency to assist in the matter.

Mr. MORTON stated, in reply to His Excellency, that there was a collection of such stones in the Museum, and also a number in duplicate. Several of the Trustees of the Museum were present, and no doubt the matter would receive consideration at their next meeting.

His EXCELLENCY said that the writer had a great deal to do with the University Museum at Oxford, having evidently made the subject a study. He thought it would be well to send the specimens, if that could be done without denuding our collection.

Mr. C. T. BELSTEAD said he was sure that the matter would receive full consideration from the Museum Trustees.

DREDGING TRIP ON THE DERWENT.

Mr. A. MORTON read some "Notes on a recent dredging trip in the Derwent." He said: "The Tasmanian Fisheries Commissioners having decided to examine the several bays in the River Derwent for the purpose of ascertaining whether as in former times there still existed natural oyster beds, advantage was taken of the opportunity to pay special attention to the marine fauna that might be obtained by means of the dredge. Mr. A. Durrand, F.R.M.S., at present on a visit to Tasmania, who has made a collection of foraminifera from many parts of the Southern seas, accompanied us on our trip. Several bays to the northward of the harbour were tried, but the dredge failed to secure any specimens of oysters, and in only one or two instances did we obtain any dead shells. Although from a commercial point of view the result of the dredging trip proved comparatively a failure, still from a scientific point we were amply rewarded. Instead of finding the oyster a large quantity of pectens or scallops were obtained. As had been pointed out by the Secretary to the Fisheries Commission (Mr. Seager), a large number of this shellfish can be obtained in the River Derwent by means

of dredging, and the quality being equal to the European scallops it is to be hoped that steps will be taken by our fishermen to place in the market this class of shellfish, which would readily find consumers. As the places dredged in were rather far up the river the number of species of mollusca was naturally limited. Several crustaceans, chiefly of the smaller kind, were obtained, one kind being found in great numbers inhabiting the common mussel. This curious little crab has a wide range common to the European seas, but, although found inhabiting the mussel of New Zealand, has not been observed in the mussel found round the New South Wales coast. A large number of species of a delicate Echin were met with, a species which is found to have a very wide range, having been obtained on the N.E and North coasts of Australia, Japan, S.E. Coasts of New Guinea, East Indies, Cape of Good Hope, New Zealand, and New Caledonia. Some five or six species of sponges were obtained, samples of which he intended to have forwarded to Mr. Arthur Dendy of Melbourne University for identification, as that gentleman is at present paying considerable attention to the spongidiæ of Australia. Several specimens of foraminifera were obtained. In concluding, he said that from the large number of specimens obtained during the trip, and considering the very primitive and unsuitable dredge in use, he was convinced that a most interesting and valuable collection of marine fauna might be obtained in the Derwent, and accordingly decided during the summer months to carry out a similar system of dredging to that which he was engaged in for the Sydney Museum on the Queensland coast and at Port Jackson during the years 1879, 1881-2. (Hear, hear.)

TASMANIAN MOLLUSCA.

Mr. A. Morton (for Mr. R. M. Johnston, F.L S.), read a paper on "Provisional aid to the study of the Tasmanian Mollusca." The writer remarked that the student of conchology in Tasmania laboured under a disadvantage in that the description of the various species inhabiting our waters was scattered widely in various publications of Europe and America, while nearly half the number of the principal type species are deposited in foreign museums and are therefore inaccessible for purposes of reference to local students. Much careful work required to be done before we could rest satisfied with existing classification of species, for it was well-known that the specific descriptions of the earlier distinguished collectors who accompanied expeditions to our seas were often too meagre to satisfactorily distinguish or separate them from many allied distinct species subsequently discovered. He suggested that the example of New Zealand should be followed in making up a duplicate collection of our shells as complete as possible, and thereafter submit them to a well-known European authority like Ed. Von Martins, who could critically examine and compare them with original types in European collections, and submit a report for guidance of local workers. If Messrs. Legrand, Petterd, and Beddome, who have so ably worked in this branch of science in Tasmania, and who possess the best local collections, were to engage in a work of this kind under the auspices of the Royal Society of Tasmania, he was satisfied that the very best results would be attained, and we would then prepare the way for the publication of a work on Tasmanian Mollusca upon which thorough dependence could be placed. He alluded also to the labours of the Rev. J. T. Tenison Woods, F.L.S., and the Rev. H. D. Atkinson, of Circular Head, in connection with this study. He gave a comprehensive account of the bibliograpy of the subject, and for the convenience of local students who are not in possession of works of reference, he added a part devoted to the description of the various families, mainly based upon the late G. W. Tryon's splendid work on

"Structural and Systematic Conchology" (April, 1884). To afford additional facilities to such students he prepared an artificial key to the classes, family, and genera, which he hoped would prove to be of service.

Mr. A. J. TAYLOR expressed regret at the absence of Mr. Johnston through indisposition. Mr. Johnston's writings were not only invaluable in themselves, but specially so as they were generally written with a view to meet the requirements of young students.

THE DOUBLE COCOANUT.

Mr. ALFRED J. TAYLOR read a paper on the *coco-de-mer* (*Lodoicea Seychellarum*) or double cocoanut, which had become interesting of late owing to some misleading paragraphs which had found their way into the English Press regarding it.

AUGUST, 1890.

The monthly meeting of this Society was held on Monday, August 12th. The President, His Excellency Sir R. G. C. Hamilton, took the chair.

NEW MEMBERS.

Mr. Thos. Whitelegge, F.L.S., Zoologist Australian Museum, was elected a corresponding member, and Mr. F. Chalk, barrister-at-law, a new member.

A FOSSIL TREE.

Mr. James Barnard read a communication which he had received from Mr. S. H. Wintle in regard to a paper read by Mr. Barnard for him at the June meeting of this year, entitled "Notes on a Fossil Tree found beneath 100ft. of basalt at Richmond, Victoria." Mr. Wintle wrote as follows :—

"I find in the discussion which followed the reading of my remarks by the Vice-President, that Mr. C. H. Grant expressed an opinion that the condition of the wood afforded satisfactory evidence that the basaltic lava which entombed it could not have had a high temperature. A moment's reflection will show that such a conclusion is quite untenable. The degree of heat necessary for molten rock-matter, such as lava, to flow, is laid down by no less an authority on Seismology than Mallet to be from 1,900deg. to 2,000 deg. Fahr., a temperature sufficient to melt copper. Mr. Grant's opinion as to a low temperature of the basalt at the time it overflowed the tree was based, I presume, upon the fact that the wood displays no sign of being carbonised, or charred, beyond a slight trace at its superior surface at the point of contact with the once molten rock. This feature, I take it, is to be accounted for by the fact that the enveloping fluid lava by excluding the air would effectually prevent an access of oxygen to the wood ; and further, that the surface of the lava-stream, which would come in contact with the tree first, is always cooler than the interior or the base of the stream. I also observe that Mr. Grant regards the basalt (a specimen of which accompanied the example of the fossil wood) as 'diorite,' according to the report referred to. With all due deference I would observe that this is erroneous. It is true basaltic lava of that kind known as Anamesite of Pleistocene Age, and not greenstone, which diorite proper is. The newer basalts, which in Victoria have filled up so extensively Miocene and Pliocene valleys, and river channels, are chiefly vesicular zeolitic *dolerites* and *Anamesites*, the former being well represented by the light coloured Malmsbury 'bluestone' so extensively employed in buildings in Melbourne."

Mr. Grant explained that he had only referred to the matter as a suppositious case, and that his remarks had been evidently misunderstood.

Mr. R. M. Johnston said he was not present when the paper was read, but he thought he knew something of the constitution of this fossil. In his work on Geology a section of the book was taken up in describing such fossil trees. From the description given he imagined that this fossil exactly corresponded with those found in the deep leads of Beaconsfield. From the appearance of those fossils it was quite possible that the wood was protected at one time by clay, which formed a protective envelope between it and the overflow of the basalt. The best specimens could be obtained in the railway cuttings at Breadalbane, where a perfect forest of the ancient vegetation of the Mesozoic period was entombed, and destroyed by the scoria and ashes and molten flows of matter from the volcanic eruptions at that time so prevalent in this and some other localities throughout Tasmania. It has been found by mineralogists that if basalt is thrown up by eruptive influence in a state of ashes, and if afterwards

chemical action takes place, it sometimes becomes perfectly crystalline, and as if it had been originally in a state of liquefaction. At Breadalbane they were seen in every possible stage. In no country in the world, so far as he was aware, was there exhibited the remains of this vegetation in such abundance in every stage as was to be found in Tasmania.

Mr. ALFRED J. TAYLOR said that judging from the remarks recently made by Baron Nordenskïold before the Royal Swedish Society of Arts, it was possible that the wood referred to might have been covered by basalt without being charred. The Baron's remarks were as follows :—"The members of the Academy are aware of the fact that on several occasions I have given reasons which tell against the supposition that the layers of basalt have been formed through eruptions of glowing melted lava. Once in Greenland I saw a phenomenon which, if it had been fully investigated, would have been of great assistance in the solving of this question. Namely, I once met with a thick '*moja*' stream, which was slowly rolling down a steep headland on the north-eastern coast of the Nuorsoak Peninsula, and which seemed to come direct from the basalt mountains. I had great difficulty in crossing this stream, which consisted of a sticky substance. Only after returning home my attention was called to the fact that this substance when hard might probably form the basaltic layers." From these remarks it would be seen that the problem referring to the formation of basalt had not been successfully settled, and that it was quite possible for Mr. Wintle to have been perfectly right in the conclusions he had arrived at with regard to the piece of wood under discussion.

Rev. J. B. W. WOOLLNOUGH said that when he was in Iceland, where there was only one living tree, he not unfrequently came across partially burned wood which had been exposed to great heat and overflows of lava, which had been protected evidently by some surrounding substance which had hindered the lava from influencing it as otherwise it would have done. In some cases the wood was only slightly charred, and it seemed to have lost almost completely its weight. When a piece was taken up in the hand it seemed as if all the weight had been pressed out of it. One piece of wood to his knowledge had been under a very thick piece of lava.

ANTARCTIC EXPLORATION.

The following correspondence from the Hon. Secretary (Mr. A. C. Macdonald) of the Royal Geographical Society of Australasia, was read by the Secretary (Mr. A. Morton) :—

"Royal Geographical Society of Australasia,
"Society Rooms,
"Collins-street W.,
"Melbourne, July 30, 1890.

"DEAR SIR,—I am directed by the Antarctic Committee to inform you that at a meeting of the committee held at the Melbourne Observatory on the morning of Tuesday, the 29th July inst., the following resolutions were passed :—

1. "The Antarctic Committee learn with pleasure the magnificent offer of Baron Oscar Dickson to defray one half the cost of an expedition to explore the Antarctic region, provided that the other half, not exceeding £5,000, be contributed by the Australasian colonies, Baron Nordenskïold to take command of the expedition. This committee cordially desires to accept the offer, and hereby resolves to appeal to the general public throughout the Australasian colonies for subscriptions towards the movement.

2. "That a copy of the foregoing resolutions be forwarded to the Royal Societies of Queensland, New South Wales, Tasmania, and Queensland branches of the Royal Geographical Society of Australasia, soliciting their co-operation.

"The Consul-General for Sweden and Norway, who was present at the meeting, kindly promised to communicate with Barons Nordenskïold and Dickson, and to transmit copies of the report of the meeting. A committee was formed to prepare resolutions to be submitted at a public meeting to be held during the month of August. Arrangements will be made for delivering one or more public lectures. Already several handsome subscriptions (two of £100 each) have been promised, and the committee feel satisfied that if a reasonable effort is made the required amount will easily be raised.

"In conclusion, the committee respectfully request your cordial co-operation in a movement which is essentially Australian and National, and which should certainly result in the acquisition of knowledge to the world, and the prospective possibilities of profitable investment.

"A. C. MACDONALD,
"Hon. Sec. and Treasurer.

"The Secretary,
"Royal Society of Tasmania."

[Telegram.] "Melbourne, July, 31, 1890.
"The Secretary, Royal Society of Tasmania, Hobart.

"At a meeting of the Australian Antarctic Committee held 29th inst., Baron Oscar Dickson's munificent offer to defray half the cost of an expedition under the command of Baron Nordenskïold, to explore the Antarctic regions, conditionally that the Australian colonies subscribe the other half not exceeding £5,000, the offer was cordially accepted, and it was unanimously resolved to appeal to the general public alone (not to Government) for subscriptions in aid of the object. Two members of the Royal Geographical Society of Australasia (Messrs. J. S. Gotch and Professor Kernot), subscribed £100 each, and several other sums have also been promised. Public meetings and lectures are being arranged. His Excellency the Earl of Hopetoun will preside at the inaugural lecture to be held early in August. The Consul-General for Sweden has undertaken to communicate with Barons Dickson and Nordenskïold. The Antarctic Committee respectfully requests your co-operation, and suggests the formation of an Antarctic Committee composed of members of your Society and other leading commercial gentlemen in Hobart. Letters embodying resolutions passed here on 29th inst. and form of subscription list by post.

"A. C. MACDONALD,
"Hon. Sec. and Treasurer, R.G.S. of Aust."

His EXCELLENCY said: It seems to me that the objects to be gained by Antarctic exploration are so numerous and important, that it seems to be strange that it should have been so long delayed. When we consider that we know almost nothing practically of these regions, that a chart has yet to be made of them, showing which points and coast lines are land and which are merely floating ice, and that the geology, botany, and natural history of this great region are all at present a blank, I cannot conceive of any more worthy field for the explorer from a scientific point of view. Moreover, until we know something of this immense area, we must remain in ignorance of the laws which govern the climates of the globe, and more particularly of the vast continent of Australia. Then again, to us in Tasmania, the nearest of the Australian colonies to these regions, the commercial aspects of the exploration may prove important, for it is quite conceivable that it might lead to a revival of the great whaling industry which was once a staple industry of Tasmania. One feels a certain amount of regret that this exploration should not have been undertaken under the British flag, seeing that the interests of the British Empire in it are certainly greater than those of any other country, but when such a noble offer has been made as that

of Baron Dickson, and the opportunity arises of having the expedition under a man like Baron Nordenskïold, I think the least we can do here in Australia is to enter heart and soul into the project, and assist it to the best of our ability. I observe that in Victoria it is proposed to raise the funds necessary by private subscriptions, and not by a grant from Parliament. So long as the money is forthcoming it does not much matter how it is collected, but on this point it would be desirable to ascertain what the views of the members of this Society are. We did all we could to push forward the last proposed expedition, which fell through unfortunately, and I feel sure that now this Society will do all it can to further the present one. I judge from the very moderate sum of £10,000, which is its estimated cost, that it can only be a preliminary and experimental one, but I have no doubt that if it brings back important information, as no doubt it will, that further expeditions will in future be undertaken to set at rest the many scientific questions which are at present locked up in this great unexplored region.

Bishop Montgomery said that before he left London he had expressed the hope that he might yet have the South Pole in his diocese. (Laughter.) This expedition was important not only from a commercial point of view, but also because it was desirable to gain a clear knowledge. We were necessarily called upon to ascertain all about our own Hemisphere, of which Tasmania might hope one day to be mistress.

Mr. James Barnard alluded to the previous movement in favour of this object when a committee was formed in 1886. He surmised from a communication he had received that that committee was now merged in or superseded by the present movement. He also considered it a matter of regret that England had not taken part in the expedition, but inasmuch as science knew no nationality, it was, from a scientific point of view, a matter of indifference whether England took her share or did not do so. With regard to subscriptions, he thought that the Government should be approached to contribute the colony's share. It seemed to him that from an expedition of this description there was no individual benefit to be derived, the benefit would be a national one, and looking upon the matter in this light he considered that the Government should be approached to give the approximate share justly due by Tasmania as a colony largely interested in the expedition.

Sir Lambert Dobson said it seemed to him that this must be a question of interest to everyone who had any regard for science. The world had now left comparatively little *terra incognita* that had not been penetrated by the explorer, and this was the only remnant of undiscovered region that concerned us. If there was any profit to come out of the expedition, or any climatic benefit, doubtless Hobart would derive the advantage. Hobart was the starting point of the last Antarctic Expedition, and he remembered the sailing of the Erebus and Terror. They had also the work of Lieutenant Hooker remaining amongst them as a standard work, and the meteorological observatory established here had proved of benefit. There was a general desire to see the far South explored, to find out if there were any fresh discoveries to be made, and he thought, whether the money came from individuals or the Government, they would all be glad to see Tasmania take part in the expedition.

Mr. A. Morton said that in 1886 the late Mr. Sprent read a paper on this subject, and it was then contended that there should be a combination of the colonies in carrying out the expedition. The project fell through at that time until now, when it was again revived. He called attention to the footnote in the circular—"Subscriptions will be returned in full in the event of the expedition failing to start from Hobson's Bay"—and said he had written for further information on the point, as to whether the same object might not be attained by the

expedition starting from Hobart or New Zealand if it was found more advantageous to do so. In 1886 Victoria led the way in this matter, followed by Tasmania, which was very enthusiastic, a deputation waiting on the Premier; afterwards New South Wales took the matter up. On this occasion Victoria again took first place, and he was glad to think that Tasmania was again second. He thought that on such an occasion the words of the late Mr. Sprent were worthy of recollection when he said, "It would be a standing disgrace to Australia if she took no part in the exploration of the seas that wash her own coast." (Hear, hear.)

Mr. ALFRED J. TAYLOR said it seemed to him that if they wished to make the history of the future, they could not do it in a better way than by supporting the expedition now under consideration. He had received several communications from the Secretary of the Royal Geographical Society of Australasia on the subject, and he trusted that something practical would be done by the appointment of a committee in Hobart.

Mr. CURZON ALLPORT said that this was a question which would involve considerable discussion, and he thought, in view of the other papers to be read that evening, that it would be as well if this subject was adjourned for future discussion. While agreeing with the last speaker as to the appointment of a committee, he totally disagreed with the proposal to make the paltry sum required a matter for the Government. The object of the Royal Society was to deal with subjects of this sort, and he hoped that they did not require to go hat in hand to the Government for the necessary sum. He considered that they would not be doing their duty if they followed the course proposed. He hoped they would be prepared to contribute a substantial amount to this object, and speaking for the Photographic Art Association, he had no doubt but that they would join in the contribution. Reference had been made to the Antarctic regions as a place of great mystery, but already they had been partially explored, and at next meeting he promised to produce a series of photographs of those regions, not taken by the Eurebus and Terror expedition, but by the officers of some French discovery ships. He had do doubt they would be of interest to the members. (Applause.)

Mr. T. D. STEPHENS seconded, and hoped the Council in the *interim* would continue its work, and place before the Society a practical scheme at next meeting.

The motion was agreed to, and the discussion adjourned.

Mr. A. Montgomery, M.A., Government Geologist, read a Paper, entitled "Notes of some Geological Observations on the West Coast."

Mr. R. M. JOHNSTON said he was sure that the members had listened with pleasure to Mr. Montgomery's paper, which was very interesting to all geologists. He had travelled on several occasions across the island, and also from North to South, and the igneous rocks had also excited his attention, especially the serpentines and greenstones. He had observed at the Queen and King Rivers rocks similar to those described by Mr. Montgomery. Between that locality and Macquarie Harbour there is an interesting section showing the Upper Silurian rocks, and he had made a large collection of Upper Silurian fossils from that region. The sandstone to which Mr. Montgomery referred occurred in several places between the Queen River and Macquarie Harbour, and at the 14-mile Hut, near the Magnet Range. This sandstone in both localities is closely associated with the serpentines, and the former is very rich in the remains of brachiopods, on account of which this sandstone was originally called by him *Brachipodos Sandstone.* There was also a very important serpentine rock described by Mr. Chas. Gould in the neighbourhood of Ilfracombe which was associated with important iron deposits that failed to be worked successfully owing to

the existence of chromium in a free state. He believed that a similar relationship existed in connection with the rocks near Penguin. The importance of this paper could not be over-estimated, and he hoped the reading of it would lead to new interest being taken in the science leading up to an intelligible account being prepared of the order of rocks from Mount Heemskirk on the west to Patrick's Head on the east.

Mr. CURZON ALLPORT thought that the Secretary (Mr. Morton) was entitled to credit for the pains he took in arranging to have such excellent papers read before the Society. The paper just read brought before them matters of great importance, and he thought such an important subject could not be dealt with upon one evening. He suggested that the consideration of the paper should be adjourned till next meeting, when he would be able to produce some information on matters touched on in the paper, and also photographs of some of the districts on the West Coast.

Mr. ALFRED J. TAYLOR seconded, and the motion was passed.

FERNS.

Mr. R. M. JOHNSTON read some notes on a fern which had been found at George's Bay by Mr. George Hinsby, and was submitted to him by Mr. Leonard Rodway. He described it as belonging to the Bleechnum Cartaligenum, a species common to Australia, but hitherto unknown in Tasmania.

Mr. A. MORTON read a paper entitled "A complete list of ferns found in Tasmania, with full descriptions of the genera and species," in which he had adopted the elaborate description, as published by Mr. G. Bentham, F.R.S., in his "Flora Australiensis," giving wherever practicable the authorities and localities where the fern is found, also the localities in which the species is found in the other colonies. It was his intention, if possible, to have the list of ferns of Tasmania illustrated.

SIR LAMBERT DOBSON said that all those who took an interest in Botany would be be glad to find that a good description of ferns has been compiled. They had this shortly done in Spicer's book, but this would be much more complete, and would be of great interest to all who enjoyed a walk in the bush. Comparatively few knew the number and names of the ferns, but this book would enable them readily to identify the plants. At one time, when Sir Henry Lefroy offered a prize of £5 for the best collection of ferns, he made a collection of 50, comprising every fern he knew of in Tasmania. He was very much pleased to see that Mr. Morton had given his attention to this matter, a pleasure which would be shared in by all those who took an interest in this attractive branch of science.

A GUM TREE GRUB.

Mr. ALFRED J. TAYLOR submitted the branch of a gum tree sent by Mr. Ward, Government Analyst, which had been eaten off by a grub.

HIS EXCELLENCY in moving the usual vote of thanks to those who had read papers, expressed the pleasure with which they had listened to Mr. Montgomery's paper, and hoped they might often receive papers from that gentleman. (Hear, hear.) He was sure that they all agreed that Mr. Morton's work would be of very great interest, and he had no doubt it would assist in cultivating a love of flowers among the rising generation. (Applause).

The vote of thanks was cordially passed, and the meeting adjourned.

SEPTEMBER, 1890.

The monthly meeting of this body was held on Monday, September 15. The President, His Excellency Sir R. G. C. Hamilton, took the chair. There was a good attendance of Fellows, and a large number of ladies were present, including Lady Hamilton.

NEW MEMBER.

Major-General Tottenham was elected a Fellow of the Society.

ANTARCTIC EXPLORATION.

Mr. MORTON reported that at a meeting of the Council of the Society the following resolution was agreed to:—"That this Society desires to express its sympathy with the proposal for the despatch of an expedition to the Antarctic regions, under the conduct of Baron Nordenskïold, and resolves that active steps be taken to collect subscriptions in aid of so desirable an object, the Royal Society heading the list with a donation of £50."

Mr. THOS. STEPHENS moved the adoption of the resolution by the Society. Most of the members would agree that it was desirable that the little known country in the neighbourhood of the South Pole should be explored, and something more known of it. It was now something like 60 years since the last attempt was made to gain any information about these southern regions, and from various circumstances that experiment was practically abortive. Perhaps the most interesting discovery during the voyage of the Erebus and Terror was the two magnificent volcanoes named after the exploring ships, and which are, perhaps, without a parallel in the known world. He did not think that the expedition should be taken up in a commercial spirit, as was suggested by some friends in the other colonies, and with the almost certain project of re-establishing the whale fishing. If people started with a foregone conclusion of that kind, he was afraid that they would be disappointed. It was better that the expedition should rest on the ground that it was undertaken in that spirit of enterprise which was the peculiar property of the Anglo-Saxon race all over the world—(hear, hear)—and with a desire to get rid of that feeling of shame which they must have at knowing so little of a country which was comparatively close to us. Much would be gained in the cause of science and otherwise by a well equipped expedition. It was incumbent on all those who could do so to help in removing some portion of the veil which now hangs over the southern part of the world. He had pleasure in submitting the resolution for the approval and concurrence of the members of the Royal Society.

Mr. JAMES BARNARD seconded. Usually the Council possessed the power to transact all business of the Society, but when the resolution agreed to involved the expenditure of money, it was thought advisable that it should receive the concurrence of members. He did not propose to speak at length, as he considered that the subject had been thoroughly thrashed out, and it was like "painting the lily" to expatiate upon it. They were simply following the example of the Councils of the different societies of Australia in voting this sum, which was in proportion to their limited resources.

Mr. A. MAULT did not intend to propose an amendment, but desired to explain why he should vote in the negative. It was because he so heartily agreed with almost every word Mr. Stephens had said that he thought the course proposed was unfortunate. They all regarded with something like a sense of shame the fact that they knew so little of a locality that was nearer to us than any other part of the world, but he did not think that that sense of shame would be taken away by the consideration of the fact

that the work was proposed to be done, not by us, but at the instigation, and with the assistance of persons on the other side of the world who do not belong to our race or speak our language. He very heartily appreciated the motives which had induced Baron Nordenskïold to make this noble offer, and would not say a word against it, but he still thought that in a matter of this sort it was a disgrace to the Australasian Colonies that the work should be in any way taken out of their hands, or conducted in a manner over which they could not exercise control. The Colonies were perfectly willing, as he was sure they were capable of doing the work, and if they took the matter in hand he was convinced that it would be much better than if done under what must be the divided counsels of people on the other side of the world and those now taking part in it from this side. The Australian Colonies were now beginning to found a Navy, and he hoped that it would gain as bright laurels in the South as the Navy of the Mother Country had gained in the North. He thought that it would be a great pity if the carrying out of such an expedition as that proposed should be in any other hands than that of the Australian Colonies.

His Excellency: It would be more in order if you propose an amendment.

Mr. Mault said he would rather vote against the motion a direct negative.

Mr. J. B. Walker suggested that voting on the question should be postponed until other matters relating to the subject were discussed, and this was agreed to.

Mr. A. Morton read a satisfactory progress report of the Joint Committee of the Royal Geographical Society of Australasia (Victorian Branch) and the Royal Society of Victoria, on the proposed Swedish expedition to the Antarctic regions. It stated that the Council of the Victorian branch of the Society had been authorised to head a subscription list in aid of the proposed expedition with a donation of £200 from the Society's funds. The starting point was altered from "Hobson's Bay" to "an Australasian port," and communication had been made with the various colonies in order to get the co-operation of the various Royal Societies in an appeal to the public for funds in aid of the proposed expedition.

Mr. J. B. Walker read a short and interesting account of the last Antarctic expedition, taken from Sir James Ross's book on the Antarctic expedition of the Erebus and Terror. The paper was illustrated by a map of the discoveries made, and in conclusion he said that whales existed in great numbers, and valuable seals might be obtained; while Ross spoke of enormous beds of guano which were practically inexhaustible. The result altogether would not, he thought, be of much value commercially, but of very great advantage to science in such problems as whether the South Pole, like the Northern regions, had once enjoyed a temperate climate, and what effect those regions had on the Tasmanian and Australian climates. The Antarctic regions were within a week's steam of Melbourne or Hobart, and he made an earnest appeal to Australasia to undertake the important work of exploring that region.

Mr. A. Morton read a paper entitled, "What Science and Commerce may gain from an Antarctic Expedition." He referred to the scientific results that had been obtained from expeditions to the North Pole in the way of the confirmation and correction of scientific theories relating to ocean currents, magnetic deviations, climatology, geographical distribution of plants, animals, etc. In respect to commerce, mention was made of the discoveries of the White Sea route to Russia and its consequent trade, the establishment of the Spitzbergen fisheries, and the opening up of new lucrative whaling grounds in Baffin's Bay. The

result of Captain Ross's trip to the South Polar regions gave magnetic researches of the highest value. Although Captain Cook had predicted that no man would venture further than he had done, viz., lat. 71deg. 10min. S., Captain Ross had penetrated 420 miles further south from the point at which Captain Cook turned back. While heartily in sympathy with the proposed expedition under Baron Nordenskiold, he thought that £10,000, the amount proposed, would prove inadequate to obtain great results, or to win more information than had been already obtained. He suggested that England and Australia should unite in sending a properly equipped expedition to the Southern Polar Sea under naval auspices and naval discipline.

His Excellency said that the Society would now further consider the resolution before it.

Mr. A. J. Taylor thought that as it had been decided that the expedition should be a joint Swedish and Australian one, it would be a pity to throw difficulties in the way of carrying it out. At the same time everyone sympathised with Mr. Mault's objection, and he suggested that the motion should be amended to express regret that the expedition had not been taken in hand by the Australian colonies.

Major-General Tottenham thought the Mother Country should also be asked to assist.

His Excellency asked Mr. Mault if the motion as amended by Mr. Taylor would be acceptable to him.

Mr. Mault said he did not wish to oppose anything that the Council of the Society thought expedient, but he thought that everything said subsequently to his remarks had confirmed what he had said. The noble words of the *Argus* in regard to the glory that awaits Australasia in accepting this duty, and the equally noble words of Mr. Walker, should have actuated a little more the different learned societies that have taken up this matter. It was a descent from this noble incentive to think that they were doing their duty by sending £5,000 from Australasia to help the Swedes to carry out the expedition. He could not accept any modification of his views, as had been indicated, but thought the question had better be debated on its merits, and the question decided whether they should or should not assist in this movement.

Mr. J. B. Walker supported the motion. He would have preferred that England and Australasia should have taken up this work, but he was afraid that years would elapse before they were stirred up to the point of enthusiasm under which they would undertake the work. He thought that when Baron Nordenskiold, an experienced navigator, offered his services, and also to pay one-half of the expense, if Australasia would supply the other halt, it would be ungenerous to say that they would not help. At the same time he hoped that this expedition would be the precursor of one of which Australasia might be proud. (Hear, hear.)

The motion was then put and carried.

Mr. James Andrew moved,—"That the Council of the Society carry out the work in connection with the proposed expedition."

Mr. J. B. Walker seconded, and the motion was agreed to.

STRIKES AND REAL WAGES.

Mr. R. M. Johnston read a paper entitled "Observations on the Influence of Strikes upon Real Wages." He described himself as one who regarded combination or co-operation amongst wage-earners as of paramount necessity to them, and that when all better modes of appeal for reasonable concessions are unavailing, the last and terrible resort "to strike" may in certain cases not only be justifiable but imperative. But a strike could only succeed in raising real wages when it was partial or confined to industries that comprise a small proportion of the com-

munity. A strike might be the means of successfully raising the status of some branches of labour that are comparatively underpaid or overworked ; it might raise the real wages of a particular country or locality which formerly laboured under the average remuneration of other countries; it might temporarily be the means of forcing the capitalist or employer to give a fairer or larger share of the profits of capital and labour, *i.e.*, machinery, plant, skill, and labour—but from the very nature of the common source of all profit and wages, viz.—the current products created by the combined services of capital (instruments) and labour), strikes could not raise the real wages of all wage-earners. Strikes could not increase the real wages or the purchasing power of a day's labour of all wage-earners. In a word, they could not divide more than what has actually been created or produced, although the nominal rates of wages and nominal prices of commodities may both be raised to any extent without real benefit to anyone. To secure a general nominal rise of wages in all branches of labour would further have the immediate effect of lowering once more the real wages of those who already had effected for themselves an advantage by successful combination or strikes. Strikes might possibly raise the nominal wages of workers all round a hundred-fold, and yet result in the positive lowering of the real wages of all workmen who, by means of organisation, hitherto have succeeded in bettering their condition as compared with their less perfectly organised fellow-wage-earners. It was the failure to recognise the essential difference between real and nominal wages that rendered futile the many schemes of sentimentalists, which have for their object the laudable design to improve the condition of the people. In conclusion, he thought it would be well for capitalists and wage-earners, employer and employed—whose interests as producers and consumers are almost identical—that when matters requiring adjustment are proposed, there should be greater facilities afforded to the Councils of both interests for securing a friendly settlement. To the absence of these facilities, and the adoption of high-handed action, was mainly attributed the disastrous evils of strikes.

Major-General TOTTENHAM suggested, as a solution of the labour difficulty, that wages should be fixed for a year, and a month's notice given of any change.

HIS EXCELLENCY thought it would be better that the discussion be confined as much as possible to the statistical and scientific effect of strikes. (Hear, hear.)

Mr. MAULT said that if the discussion was to proceed on the lines suggested, an opportunity should be afforded of considering the paper read. He would move the adjournment of the debate.

This was agreed to.

THANKS.

His EXCELLENCY moved a vote of thanks to the gentlemen who had read papers, and a special vote of thanks to Dr. Agnew, who had presented the Society with three volumes giving a report of the scientific results of the exploring voyage of H.M.S. Challenger, 1873-76. The volumes are beautifully illustrated.

The votes of thanks were cordially passed, and the proceedings terminated.

OCTOBER, 1890.

The monthly meeting of this body was held on Monday, October 13. The chair was occupied by the President, His Excellency Sir R. G. C. Hamilton, and there was a good attendance of Fellows. Several ladies were also present.

NEW MEMBERS.

The following gentlemen were elected Fellows :—F. J. Jacobs, J. H. Downie, W. G. Browne, L. Chambers.

Mr T. A. Urquhart, of New Zealand, was elected a corresponding member.

The secretary drew attention to three specimens of Salmonidæ hatched from the late shipment of ova brought out by Sir Thos. Brady, the gift of the Hon. J. W. Agnew. The fish were obtained from the Salmon Ponds, one answering undoubtedly to the description of the true salmon, the other two being unmistakably trout, clearly showing that with all the care and attention paid to the selection of true salmon ova by Sir Thos. Brady, certain ova of trout had been sent out with the late shipment It was extremely satisfactory to learn that, although there appeared to be a mixture, a very large percentage agreed to the description of the true *Salmo salar*. He also directed attention to the fish caught on Saturday in the Derwent, which, he said, although a very fine fish, did not agree with Gunther's description of the true *Salmo salar*, but similar to the fish recently caught in the Huon by the President. A gentleman passing through Hobart, and whose experience in the matter was that of having been a manager of a Scottish salmon fishery, had viewed the fish, and pronounced it to be a bull trout.

Mr. JOHNSTON questioned whether the different circumstances surrounding the fish in these waters had not occasioned a breakdown of the racial distinctions between the *Salmo salar* and the *Salmo trutta*, together with the theoretical classification of the true *Salmo salar*. The circumstances also tallied with the experience of New Zealand in this matter.

Mr. MAULT asked had this change of the surroundings had any effect upon the quality of the fish.

Mr. JOHNSTON considered the flavour qualities of the fish would be equally affected with the other qualities of the fish. The question he had just raised had never been put to any Home authority. This degeneration of the qualities of the fish was experienced in different waters in Scotland, the finest fish being found in the colder waters.

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Secretary stated that he had received a letter from Professor Hutton, of the Canterbury University, Christchurch, New Zealand, stating that the New Zealand Government had passed a vote of £500, and that the Government Printer had been instructed to do all the printing required by the Association free of charge ; also that the hon. sec. had been authorised to frank all telegrams, letters and parcels in connection with the Association. The meeting to take place in January, 1891, and considering that the next meeting would be held in Hobart the following January, 1892, it was to be hoped the Government would act as liberally as the New Zealand, Victorian, and New South Wales Governments had done, the two latter having voted sums each to the Association.

Mr. R. M. JOHNSTON said as the New Zealand gathering was approaching it would be well to get an expression of opinion from the

people of the colony and the Government as to the welcome which would be extended to the Association, because this should be ascertained before the meeting in question, so that the representatives of Tasmania might be in a position to reiterate their previous invitation to the Society to hold its 1892 meeting in Hobart. He moved that the Council wait on the Government, and ascertain what they are willing to do in the matter.

The motion was agreed to.

ANTARCTIC EXPEDITION.

A subscription list for this Expedition was laid on the table.

TASMAN'S JOURNAL.

Mr. J. B. WALKER read a paper on "Notes on the localities mentioned in the journal of Tasman's discovery of Tasmania." In this he sketched the two voyages made by Tasman, in the first of which he discovered Tasmania and New Zealand (1642), and in the second of which he explored the west, north-west, and north coasts of Australia and the Gulf of Carpentaria (1644.) These voyages completed the circumnavigation of New Guinea and Australia. The writer then proceeded to identify the parts of the Coast mentioned by Tasman, and the conclusion he had arrived at regarding the land fall made by the discoverer was that it was the high land north of Macquarie Harbour. He then proceeded to discuss the site of Tasman's anchorage on the East Coast near Cape Frederick Henry, and pointed out that the name of Frederick Henry Bay, now applied to part of Storm Bay, was originally given by Tasman to what is now known by the name of Blackman's Bay.

Mr MAULT described a method in which he had traced Tasman's land fall, fixing it slightly further south than Mr. Walker. There were three maps in the British Museum among the additional manuscripts, No. 8,946, which had never been published. It would be well if the Government could be got to publish these.

NEW TASMANIAN SPIDERS.

Mr. MORTON stated that he had lately been making a collection of Tasmanian spiders. Some of them he was unable to determine, and had forwarded to Mr. A. T. Urquhart, of New Zealand, the collection for examination. Mr. Urquhart was one of the best authorities in the colonies on spiders, and on examining the collection he had found some new species of the genus *Eperidæ* five new kinds of that genus, two new species of the genus *Thalaosoma*, while he had been able to form two new genera which he had named *Alrea* and *Collina*. Accompanying the paper was a plate of the species referred to.

OSTRICH FARMING.

Mr. JAMES ANDREW read a paper on the subject of ostrich farming, and the possibilities of successfully introducing this industry into Tasmania. The remarks set forth were based on personal observation of wild ostriches, and experience of the management of the bird in a domesticated state. After a brief sketch of the bird and its habits, together with some of the uses to which the eggs are put by Bushmen, the writer proceeded to deal with the subject of ostrich farming, and pointed out that the Egyptians were the first people who had undertaken the taming and utilisation of the bird. The first modern step in this direction occurred rather less than 30 years ago in Cape Colony. It was not necessary to have large enclosures in which to confine the domesticated birds for herding purposes. but each pair required to be separated. The male bird was most pugnacious during the nesting season, and could only be approached in safety with great precaution. The formid-

able character of a kick from an ostrich was exemplified by the fact that at Graff Reinet the back of a horse was broken by one such blow. The best means of escaping injury when attacked by the bird was to lie down and submit to the inevitable pummelling he would administer. The writer inclined to the natural hatching of the eggs by the birds as preferable to the use of incubators, although the incubator was an essential appliance for use in the case of emergencies. The process of clipping and preparing the plumage for market was described, followed by examples of high prices paid a few years ago—the halcyon days of ostrich farming for both bird and plumage. The growth of the industry in Cape Colony was such that from 80 tame ostriches in 1865, in 10 years the total had reached 32,247, and the export of feathers was 49,969lb., valued at £304,933, and in 1882 feathers were exported to the value of £1,093,939. Recent statistics showed that the supply had exceeded the demand, and the enomous profits arising in the past from the sale of the young birds and feathers would never again be realised, but substantial recompense would still be earned by a skilful and intelligent management. The bird could be raised in any temperate climate, and dry level wastes might be found suitable for the industry. In Africa the birds had so lost their value they were not worth recovering when they strayed, and it was proposed to repeal the Act protecting the bird.

COMPLIMENTARY.

The PRESIDENT moved the usual vote of thanks to the contributors of papers, after which the meeting adjourned.

NOVEMBER, 1890.

The last monthly evening meeting of the present Session was held on Monday, November 17th, 1890. The PRESIDENT, Sir R. G. C. Hamilton, was in the chair.

NEW MEMBERS.

Messrs. A. J. Ogilvy and A. R. Browne, M.A.M.I.E., F.G.S., were elected Fellows of the Society.

AUSTRALASIAN ASSOCIATION.

The Secretary (Mr. A. Morton) read a letter from the Hon. P. O. Fysh, Premier, intimating a vote of £500 from the Government towards defraying the expenses attendant upon the 1892 session of the Australasian Association which is to be held at Hobart. He also intimated that congratulations had been received from New South Wales, Victoria, and New Zealand, at the proposed arrangements for holding the meeting here in 1892.

STRIKES AND WAGES.

Mr. A. J. OGILVY read a paper, in which he asked the question, Can the toiling masses really improve their condition by these incessant and unhappy strikes, or are they only beating their hands against the iron bars of inexorable economic law? The paper was a reply to the paper read by Mr. R. M. Johnston at the September meeting on the influence of strikes on real wages. Dealing in the first place with the question as it affected primary industries, that is those which are concerned in extracting or producing the raw materials of wealth from the land as in agriculture or mining, he contended that in all such industries every increase of wages would come out of rent. He regarded rent as the surplus which remained after paying working expenses and tenants' ordinary profit. Every rise in the expenses or fall in the profits would reduce the rent proportionately, and, therefore, he concluded that in every department of industry which is concerned in supplying the raw material of wealth from the land, every enforced rise of wages will be clear gain to the labourer, but the loss would fall on the landlord, and stay there. In the secondary industries of manufactures and commerce which were engaged in working of and distributing the material produced by the primary industries, increased wages signified increased price of goods. Those goods were of two kinds—those which the masses consumed, and those which they did not. After pointing out that a vast proportion of industry was concerned in providing luxuries and enjoyments for the rich, he concluded that in all those commodities which the underpaid do not consume, the loss due to increased wages would fall upon the overpaid, and stay there, again leaving the whole net gain to the labourer. On those goods which the masses consumed the strikers would suffer loss, but the loss would not equal the gain. It was said that if the upper classes lost so much there must be so much less employment for labour, and so the loss will come round to the labourer after all. He maintained, however, that there would be no less employment. For, he asked, why will the upper classes have got so much less? Simply because the lower class have got so much more. It is not a loss, but a mere transference of employing power. What the masses want more money for is to spend it, and they can only spend it in purchasing goods and hiring services just as the upper class did They will in short, to the extent of the transference, be employed by each other instead of by their old employers. There was, of

course, a limit to the rise of wages, but this limit was a long way off. The labourer could not earn more than his labour produced, but what the labourer actually got was a very small portion of what his labour produced. In conclusion he pointed out that a more equitable distribution of the produce of labour was a boon so great in itself as to be well worth some cost, and that we need not be dissatisfied because less luxuries are produced for the few very rich, if more comforts are provided for the many poor; not even though the loss in value on the luxuries exceeds the gain in value on the comforts.

Mr. R. M. JOHNSTON read a paper criticising Mr. Ogilvy's views. He said it afforded him great pleasure to find himself in agreement on so many points with one like Mr. Ogilvy, whose well-known generous sympathies for the amelioration of the condition of the masses of the people must command the respect of all right thinking persons. He took exception, however, to several of Mr. Ogilvy's arguments, notably to that regarding rent. He favoured Ricardo's theory, now almost universally accepted, that "the rent of land is determined by the excess of its produce over that which the same application can secure from the least productive land in use." He also laid it down as an accepted doctrine of political economy that rent formed no part of the price of agricultural produce. He dwelt at length upon this point, and illustrated by a table that any increase in wages must fall upon consumers and not upon rent of landlord or the profit of the capitalist. He combated the idea that the rich spent more in luxuries, pointing to the large sums spent by the working classes in liquor and tobacco. He held that Mr. Ogilvy's objections to his papers were based upon assumptions which could not be sustained when subjected to close scrutiny, and he could only re-affirm that it was by increase of savings properly applied in the creation of instruments, which will still more greatly multiply the power of man that any improvement in the condition of the masses can be successful. Without this the mere raising of wages could only benefit a few industries at the expense of the many.

Mr. OGILVY said that the Society had now the two aspects of the question before them, and it was for the members to judge. Mr. Johnston had based his arguments principally on the generally accepted opinion of Ricardo, but it should not be forgotten that the British Parliament had repudiated it, in regard to the Highlands of Scotland and Ireland, by the establishment of Land Courts, which introduced an artificial element into what was held by some economists to be a natural law. In regard to what Mr. Johnston said about the rent forming no part of the price of agricultural produce, there were some farmers present, and he asked them if they had to pay twice as much as they now did for their labour, would they pay as much rent?

Mr. W. E. SHOOBRIDGE also spoke on the subject at some length, pointing out that the prices of labour were to a great extent fixed by combinations which had been the secret of the success of all strikes. He hoped the time would speedily come when arrangements would be made whereby the labourer could get his fair share of the products of labour without recourse to strikes.

ACTINOMYCOSIS AND TUBERCULOSIS.

Dr. BARNARD read a paper on this subject, dealing with its transmissibility of bovine diseases to human beings by the consumption of the meat of diseased animals. He showed that such diseases had been transmitted. A central Hygienic Institute was recommended by the last Intercolonial Stock Conference, to which all cases of disease amongst animals should be referred from all the colonies. Without some such institution it was not easy to see how

they could be informed to what extent these diseases prevail in our midst. He considered that a similar institution should be founded in connection with the Health Department of this colony, as modern science now was not content with mere superficial examination, but proceeded with more strict and reliable methods to detect the micro-organisms which are undoubtedly the active agents in the production of disease. The paper was illustrated by microscopical specimens of these diseases prepared by Mr. Archibald Park, M.R.C.V.S.

COAL SPECIMENS.

Mr. CURZON ALLPORT showed a number of specimens of coal from the mines at New South Wales, and New Zealand.

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered the following address :—

Fellows of the Royal Society.—During the session of 1890, which this evening comes to a close, the number of our Fellows has been increased by sixteen, and of our Corresponding Fellows by two. The additions to our library have been very satisfactory, and include the three handsome volumes containing the record of the Challenger Expedition, for the gift of which we are indebted to our honorary secretary, Dr. Agnew. I am personally gratified to learn that the Encyclopædia Britannica, which I presented to the Royal Society in the beginning of the year, is being largely referred to by members, who find it of much assistance to them in some of their studies and investigations. The annual proceedings of kindred societies throughout the world, which form perhaps the most important part of our Library, are constantly increasing, and here I would point out that, having regard to the time which often elapses before such volumes are printed and distributed, we may regard with some satisfaction the fact that at our opening meeting this session we had on the table the printed proceedings of our Society for 1889. It is true that this is the first time that this has been done, but I think we may feel pretty sure that our energetic secretary, Mr. Morton, having accomplished this once is not likely to observe less promptness in the publication of our annual proceedings in future. Our monthly meetings have been well attended, and 22 papers have been read before us. In Zoology we have had five papers. The first by Mr. R. M. Johnston, entitled "Further Observations upon the Fishes and Fishing Industries of Tasmania, together with a revised list of indigenous species." Eight years have elapsed since Mr. Johnston contributed a similar paper to this Society, and during that time, from additions made mainly by Mr. Saville-Kent, Mr. Morton, and Mr. Johnston himself, the 188 species then known have increased to 214. The next, also by Mr. Johnston, on "Tasmanian Mollusca," in which he points out how much there is to be done in connection with this subject to secure a satisfactory classification of species. Then we have had a paper by Mr. A. T. Urquhart, of New Zealand, on some Tasmanian spiders sent to him by Mr. Morton for examination, in which he pronounces the collection to contain not only several new species but also two new genera. Mr. Morton contributed an interesting paper on a recent dredging trip in the River Derwent. He was fortunate in being accompanied on this trip by Mr. A. Durrand, a Fellow of the Royal Microscopical Society, who has made a collection of foraminifera from many parts of the Southern Seas, and who, it will be remembered, at one of our meetings exhibited some interesting microscopical preparations of these, and of other minute marine organisms. Owing to the primitive description of dredge used on this trip, the results from a scientific point of view were not so great as they might have been, but they were quite enough to justify Mr.

Morton in determining to carry out in the summer months of this year a more complete system of dredging, similar to that adopted by him some time ago on the coast of Queensland. The lastpaper bearing on Zoology was read by Mr. Andrew on ostrich farming. In this paper he gave, from personal observation and experience, some account of the bird and its habits when in a domesticated state. In Geology we have had from Mr. Johnston and Mr. Morton a description of a second ganoid fish from the Lower Sandstones near Tinder Box Bay, similar to the one discovered last year, which the discoverers named after me, *Acrolepis Hamiltoni*. Mr. W. A. Montgomery read "Notes of Some Observations of the Geology of the West Coast," a subject which is of particular interest at the present time, and Mr. Barnard, our respected vice-president, brought under the notice of the Society some notes by Mr. S. H. Wintle respecting a fossil tree found beneath a hundred feet of basalt. In botany we have had some notes by Mr. Johnston on the discovery of a fern, hitherto unknown in Tasmania, although found on the continent of Australia, and Mr. Morton has compiled "A Complete List of Ferns found in Tasmania, with Full Descriptions of the Genera and Species." In this list, which will be invaluable to students and collectors, he gives so far as is practicable the authorities and the localities in Tasmania where each fern is found, and the locality in which the species is found in the other colonies. In this section also Mr. A. J. Taylor read two papers, one on coco-de-mer, and the other on the native hop as a cure for hydatids. In meteorology we have had a paper from Mr. E. C. Nowell on the influence of the moon on the rainfall, and on this paper Captain Shortt made some interesting remarks in which he stated that his observations showed that the influence of the planets also over the weather is considerable, and he promised a paper on this subject on some future day. Dr. Barnard has submitted to us a very important paper this evening on "Actinomycosis, Human and Bovine, and its relations to Tubercolosis, illustrated by mounted specimens prepared by Mr. A. Park, M.R.C.V.S." From Mr. J. B. Walker we have had two further contributions respecting the early discovery and settlement of Tasmania, the first entitled—"Notes on the localities mentioned in the journal of Tasman's discovery of Tasmania," and the second on the settlement of Northern Tasmania, in which he describes the discovery and occupation of Port Dalrymple and the River Tamar. Mr. Walker also contributed a paper on the Antarctic Expedition of the Erebus and Terror. This latter paper, although only a compilation from Sir James Ross's book, is of much interest at a time when further Antarctic exploration is being carefully considered and discussed. In connection with this subject also, Mr. Morton read a paper on "What science and commerce may gain from an Antarctic expedition." The interesting correspondence which has taken place with the Royal Society of Victoria on this subject will, of course, be printed with our proceedings. Baron Oscar Dickson has undertaken to furnish an expedition which Baron Nordenskiold is to take command of, provided the Australian colonies contributed £5,000—a moiety of the estimated cost of it. Our Society has voted £50 out of its funds towards this object, and further contributions will, it is hoped, be forthcoming. Although it is, I believe, the general desire of our members, and, I may say, of Tasmania generally, to do our part in helping forward this scheme, the munificence of which on the part of Baron Dickson we so heartily appreciate, yet there is, I gather, a strong feeling in the community generally that it will only be by a fully equipped expedition, involving a very much greater outlay than £10,000, under the British flag, promoted jointly by Australia and the Mother Country, an expedition which will have to pass at least one winter in the Antarctic circle,

that the many interesting questions now locked up in that imperfectly unexplored region can be fully settled. In Social Science we have had two papers from Mr. Johnston, the one, "Root matters in social and economic problems" (second series), and the other, "Observations on the influence of strikes upon real wages." This second paper of Mr. Johnston's was followed by the paper entitled "Can strikes really improve the condition of the masses?" read this evening by Mr. A. J. Ogilvy, whom we are glad to welcome as a new working member of this Society, and by Mr. Johnston's rejoinder. Such subjects do not admit of the mathematical demonstration of a problem in Euclid, and difference of view will prevail. But we may congratulate ourselves on the presence amongst us of two such able exponents of the different views held on this subject, and it is only by full and free and fair discussion in a science like this, if indeed science it can be properly called, that truth can be elucidated. At our first meeting this session, Mr. Barnard gave us some account of the meeting in Melbourne in January last of the Australasian Association for the Advancement of Science. He drew our attention to the fact that it had been provisionally settled at that meeting that the gathering of the Association for 1892 should be held in Hobart. This provisional arrangement will have to be confirmed at the meeting of the Association, which is to be held in Christchurch New Zealand, in January next, but there is little doubt that this confirmation will then take place, and that we shall have the privilege of welcoming the Association in Hobart in January, 1892. You have heard read this evening the letter of the Premier respecting the contribution of the Government towards the expenses which will be incurred on this occasion. I think we may regard this letter as quite satisfactory, and I confidently look forward to the meeting of the Association in Hobart in 1892 being a thoroughly successful one. I will do my utmost to secure the presence at this gathering of some distinguished man of science from the old country, but of course I cannot be sure that my endeavours in this direction will be successful. You may remember that the cablegrams some time ago announced that Professor Huxley was on his way to New Zealand by way of the Cape, and I took the opportunity of referring to this at one of our meetings, and suggested that we should prepare for his reception in Hobart, which he was to touch on his way. Unfortunately this rumour proved to be incorrect, but I have always understood that the Professor had it in contemplation to visit Australia some time or other, and it would be a great triumph if we could secure his attendance during the meeting of the Australasian Association for the Advancement of Science, to be held in Hobart in 1892. Although the work of the session is very creditable we might well have received more contributions from our members. With the single exception of Dr. Barnard, whose important paper has been read this evening, we have received no contribution this session from any of our medical members, who from their scientific knowledge might in so many directions have produced interesting work for us; and I would again press upon their attention that we should much value a more active co-operation on their part in the work of the Society. In conclusion, I would desire to record our thanks to those members who have submitted papers to us, and particularly to Mr. Johnston, whose versatility is as great as ever; to Mr. Morton for the energy and ability displayed by him in the discharge of his duties as our secretary; and to the Press for their full reports of our proceedings.

On the motion of Bishop MONTGOMERY thanks were voted to His Excellency for his address and for presiding at the monthly meetings.

The proceedings then terminated.

ROOT MATTERS IN SOCIAL AND ECONOMIC PROBLEMS.

By R. M. Johnston, F.L.S.

(*2nd Series.*)

Natural Limits to the Numbers Engaged in Various Occupations.

Most writers on social problems tacitly assume that no other considerations than those of supply and demand, or competition and remuneration, need be taken into account when questions relating to the numbers that may be employed in the various branches of human industry are concerned. Indeed so able an exponent of the principles of Political Economy as Mr. Henry Sidgwick, assumes with confidence that the adjustment of the apportionment of the employed in the various divisions of industry is sufficiently determined by "rates of remuneration." He states (p. 182 "Principles of Political Economy"): "We assume that labour and capital are *mobile* or capable of being attracted by a higher rate of remuneration, both from district to district, and from industry to industry, so that not merely are the wages paid for the same quality in any one industry approximately the same, but also when the remuneration of labourers or capitalists in any industry is known to be higher than that of labourers or capitalists in some other industry entailing no more sacrifice or outlay, and requiring no scarcer qualifications, the difference tends to be gradually reduced by the attractions which this higher remuneration exercises on actual or prospective labourers or employers."

There is not the faintest recognition here of natural limits to or absolute necessity for employment in a given direction, irrespective of the aggregate intensity of energies expended, or market rates and prices. Neither does he recognise the universal truth in matters animate and inanimate, that mobility or movement in a new direction requires a fresh expenditure of force commensurate with the nature of the subject, the time occupied in transition, and the friction to be overcome due to inertia or foreign resisting media. A physicist would never dream of discussing the mobility of material substances in such a loose way. He would first consider the mass or weight of the substance: the distance and direction of movement: the rate of movement and time: and the friction due to inertia or existing

diversity of movement: and from these he would compute the fresh demand upon energy or force to execute the desired movement.

Because the Political Economist does not think, or does not choose to think, that the transfer of a labourer or capitalist to a new place, or to a new kind of occupation, involves a process analagous to the movement of inanimate bodies, it is not the less true. Take the case of a shoemaker reduced to a state of idleness, or partial idleness, by competition among excessive numbers, or some other cause, locally or generally.

We will suppose that this workman has a family of 5 persons, including himself, to provide for, in addition to his quota of expenditure required for State purposes, such as General Government, Law and Protection, including Gaols, Military and Naval Defences, Police, Education, Public Hospitals, Asylums, support of Paupers, etc.

It is obvious, therefore, that when fairly employed in this branch of labour—making boots and shoes—he is not merely rendering reciprocal services to his countrymen, but he helps them to provide for such expenditure as the requirement of the particular State demands. The greater the effort or energy expended by him during the year, the greater is the value of products by him added to the common wealth, in all these respects, in addition to the important part of support of the four dependants specially related to him.

Under ordinary circumstances (excluding foreign interference, and making due allowance for special skill), all branches of services within a certain country are paid at rates of wages which are, broadly speaking, correlative to effort or time expended, and consequently so long as the rates of wages are locally proportionate to definite effort and skill, it matters not whether the average rate per hour be nominally high or low, so long as expenditure is also determined locally by such correlative conditions. Thus, take the following illustrations: Suppose the price of bread is determined by a daily effort of 10 hours, and that all other services are modified and constantly exchanged in prices which, whether high or low, are also proportional to the *nominal price* of, say, the *quarter of wheat.* Under such circumstances it would not matter to the shoemaker whether the *nominal* amount of his wages was high or low, for it would have the same *purchasing power* over the things which he required to satisfy the wants of himself and family, besides the proportion required from him for the *service* of the State. Thus if the standard—the *quarter of wheat*—bore always the same relation to his remuneration for 10 hours labour and to the various items of his expenditure, it mattered not a whit to him whether the nominal money cost of wheat was high or low. In Australia

the average relation between a breadwinner's effort expended and a quarter of wheat usually represents $44\frac{1}{2}$ hours labour, equal to $5\frac{1}{2}$ days labour (8 hours) nearly. If, therefore, the quarter of wheat, and other things (including expenditure) always bore a corresponding relation to each other, as $44\frac{1}{2}$ hours common labour bears as the equivalent to one quarter wheat, it follows of necessity that nominal prices, whether high or low, would not increase or decrease his receipts or expenditure, nor his average gains or losses. Thus, so far, the various divisions of labour within any one State would never be affected in reciprocal interchanges with each other by alteration in the nominal cost of services, so long as the alteration in cost was a general one within the State, and governed solely by local natural conditions. But a different result would follow, so far as the shoemaker is concerned, if manufactured boots and shoes were largely introduced from a country where nominal money prices were generally much lower, or where the average breadwinners of the population—reduced to a perilous condition—were forced to increase their expenditure of daily effort relative to the standard of cost of one quarter of wheat to 89 hours, or $7\frac{5}{12}$ days labour of 12 hours per day. The local shoemaker would not have the advantage of distance and cost of transit, as in the case of the local quarryman or coal miner, for shoes and boots can be transferred long distances at a relatively small cost, and hence, if not protected in some other way, the local shoemaker would be unable to compete with the foreign low-paid worker. Not only would he have to increase his efforts to the same extent as the foreign competitor, but, were it not impossible, he would have to *exceed* his efforts before he could drive the foreign competitor from the field; failing this he would be reduced perhaps to half-time employment at the foreign rate of wages, and, probably, soon he and his family, overwhelmed with poverty, would become local victims to competition; and instead of being a help to the State would become dependants upon the rest of the bread-winners, thus increasing their State burdens.

It is usual with theorists to talk lightly of the *mobility* of labour under such circumstances, and to show that the local shoemaker, finding himself unable to compete in his capacity as shoemaker, would at once transfer his services to some other branch of labour, where it is supposed by theorists that there is always some providential provision. But all such writers do not seem to be aware that in a country where manufacturing industries do not dominate, there is a tendency to narrow the scope of operations, and to close more and more the doors of entrance to the remaining branches of active industries in proportion to the number of local industries actually driven out of existence by the influx of

foreign manufactures. This is undoubted so far as the local market is concerned. No one can affirm with reason that an industry driven out does not correspondingly delimit the demand upon the *local market*. Logically, therefore, the only direction in which our shoemaker could maintain his existence as a breadwinner would be (1.) To convert himself into a labourer in raw products, for which there is still a profitable demand in *foreign markets*. (2.) Transport himself and his family to a country where his particular services are in demand, or (3.) Starve or become dependent paupers supported by the local State, already too heavily burdened by Poor Rates, etc.

In theoretical discussion this case would be disposed of by wordy wrangling, or special pleading; indictment of the capacity or lack of reasoning power of opponents; references to alleged harmonies of competition; and to dogmas and general conclusions of various Political Economists of accepted authority.

The usual ruts of controversy may afford ample opportunities for theorists to display literary skill, aided by the usual handy assortment of stock illustrations. But instead of a literary sham-fight, let the theorist enter into the real difficulties by discussing the matter practically with the distressed shoemaker. For this purpose we will take a common incident in these colonies.

A Deputation From the Shoemakers Driven out of Employment by Competition with Cheap Foreign Manufactures.

Shoemaker, Spokesman for Deputation. *Theorist*, representing the Government.

Shoemaker.—On behalf of myself and my distressed fellow-workmen and their families, I have been asked to represent to the Government the terrible distress into which we have fallen by the influx of manufactures of boots and shoes from Europe at such low prices that we have not only been knocked off employment by local manufacturers, who were unable to compete with foreign houses, but we find that as individual workmen, with such high ruling rates in rent, clothing, and other necessaries, besides a high local taxation, we are unable to earn enough to maintain ourselves and families—even if we were able to get *full employment* at the foreign selling prices.

Theorist.—I sympathise deeply with your distress, but we cannot interfere with the laws of free interchange. You must therefore seek employment in some other way.

Shoemaker.—But we cannot turn our hands to another trade, and even if we tried, we would have to spend years as

apprentices. Even in our own trade we had as young men to spend three or four years as apprentices, partly or wholly supported the while by our parents. Now we have no such help. On the contrary, we are each burdened with the support of a family. Even if we could manage for ourselves, what is to become of our families in the meantime?

Theorist.—I admit this difficulty, but is there not plenty of work open to you in this country, where you could turn your labour to account where no special skill is required, or, at any rate, where bone and muscle is all that is necessary.

Shoemaker.—True, in time some of us might obtain work as labourers in the field among farmers, or on public works or mines; but the failure in our own industry, in such a thinly populated country, causes a depression in nearly all local occupations; for it must be admitted a considerable portion of the products of other trades and industries have been directly affected by our distress and lessened consumption due to our lack of purchasing power. Besides, I have been told by farmers that they have themselves long struggled with adverse circumstances in competing against more favoured agriculturists in America—who are able to sell in European markets—our only customers—at prices which tend to become lower year by year, and if a local market is not soon established, many of them will have to give in. If other trades in turn are crushed by foreign competition as we have been, what hope have the farmers of holding on, let alone the outlook for their own children, where every branch of industry seems to be already overstocked, even in this rich and extensive country, with a sparse population. In addition to what I have stated, I am informed by those who have given much attention to agriculture, that there is only a limited amount of land whereon agriculture might be successfully carried on, but this form of industry will not admit of the employment of more than 35 persons to the square mile of land in cultivation; and if this be so, and if farmers cannot exchange products of the same kind with each other, how can a local market become a possibility in the absence of a local community of trades and manufactures?

Theorist.—I admit that the home-trader and home-workman may *temporarily suffer loss* from the competition of foreign traders and workmen in the same branch of industry; but it must be remembered that *everything* will again be adjusted, because capital is constantly exerting a tendency to *smoothe down* any *temporary inequality* in the profits of different trades. Even if you suffer from foreign importations the Government is not bound to protect you: for there can be *no right* which has a juster claim than that every individual of the community should be freely permitted

to obtain commodities where he can buy them on the cheapest terms, and to sell them where he can realise the highest price.

Shoemaker.—It is easy for theorists to write such things. I am unable to understand exactly what you mean by suffering a *temporary loss*, or what the process may be which you euphoniously term a tendency to *smoothe down any temporary inequality*. I and my fellow-workmen are now unemployed. Many of us with our families are in great distress. Without *instant employment or relief from some source many of us will die of starvation.* We have no means, and if we had we do not know where to go to better our miserable condition. Do you mean if many of us succumb and die from want and misery, thereby thinning our own ranks as competitors for the existing small field of employment still remaining—that *this is the smoothing down process* to which we are referred for comfort. Good Heavens, surely not this? Remember that we are human beings, not machines! The machine may stand idle for a time and live; men cannot. Friction in inanimate machinery means dissipation of power in heat. With men friction means distress, misery, and death. Men are not machines, and loose analogies based upon the laws of physical processes cannot be grimly applied to men fighting for life and exposed to suffering. You say that Government is not bound to protect its own workmen, and that there can be no right having a juster claim than that every individual should have the most absolute freedom in buying in the cheapest market and selling in the dearest, irrespective of any local claims of sympathy, or national or racial ties of common interest. Such a commercial law, not bond, cannot be consistent with the conditions which necessitate the maintenance, defence, and independence of disconnected individual nationalities. To be logical, it would necessitate the breaking down of all individual States, all individual race conglomerations, and the fusing of all human elements into one grand State of the world. Until that time arrives there must of necessity be localised interests governed by the same local general conditions which maintain separate nationalities. All the social organisations of the State, such as Railways, Roads, Bridges, Harbours, Post and Telegraph, Schools, Defence and Protection, Poor Laws, etc., can only be logically maintained upon the admitted necessity of some common local national interest, having special concern for the general welfare of the particular nation; and these special local interests are so intertwined by so many bonds more precious than mere questions regarding *absolute cost of products in money*, that it seems absurd to say that the destruction or suffering of any of its

members are locally only of equal concern to a corresponding evil in a foreign state similarly constituted. The necessary gravitation and concentration of interests and sympathies around home and fatherland are as natural as perspective in optics; the greatest density must be near the centre of—self, home and family—becoming weaker and weaker as the relative rings of friends or relations, club, townsmen, nation, race, are passed through to the thinner sympathies lying beyond, embracing humanity generally, where foreign races and states are bound in; and they themselves are related obversely to us in a similarly graduated series of interests and sympathies. It is this grand gravitation of human interests and sympathies which make possible ideas and forces, which make home, friend, and fatherland; and these—not nominal cost of products—are the great factors which determine the energies and welfare of any community. Commercial laws tend to destroy the heart of all ideas which centre in home and fatherland, and if the nation is to live, it must carefully guard against its decrepitating influence. Its shuttle seems just as ready to weave the shroud of a nation as to bind nations in bonds of broader sympathies.

Dominating Wants Determine Occupations and Necessarily Produce Inequalities in the Form of Services.

Hitherto in the writings of Social Reformers the greater part of their attention has been confined to the monopoly by the poor of the lands, houses, railways, and other instruments connected with the production, security and distribution of the necessary wants of human beings. It is generally assumed that there is abundance of primary satisfactions for each one if the aggregate products annually created were more equitably distributed. But if even the necessary primary satisfactions were annually produced in sufficient quantity for the wants of all, it would go to prove the curious and inexplicable circumstance that the present haphazard training and supply and demand of those who are engaged, or who are being trained to engage in the various divisions of labour, are in perfect harmony with conditions which combine to effect a result which might seem too formidable if undertaken by the most absolute regulations of intelligent prevision. The present supply of satisfactions is determined by the estimates or combined action of self-interested producers. It cannot be affirmed on the basis of *producers' self-interest*, that wants are produced with the sole idea of providing the highest quota of satisfactions to each individual; at best they favour the *minimum* supply, as self-interest is best rewarded by a keen demand involving high prices; a result which would not be

attained if the *maximum* quota of satisfactions for each individual was created. Of course the absence of a perfect scheme of combined prevision among producing competitors, and the unforeseen variable effects springing from natural causes year by year, often produce abundance, or superfluity, or over-production, as it is termed; but this is a result not premeditated, and although favourable to consumers for the time being, it is a mere accident causing a fall in prices, and is likely to be followed by purposeful under-production during the succeeding period, in order to produce a straitened market with a corresponding rise in prices, and results in a certain reduction of the ideal quantity of satisfactions falling to the lot of each consumer of the poorer classes. But this tendency of *self-interested* producers, striving to produce *under* the necessary requirement, is just the very condition for involving the poor in the continual battle with poverty and want;* and all that can be said in favour of self-interest, is that hitherto there has been no better method devised which would so effectually serve the *majority* of human beings.

Is it to be wondered, then, that the *less fit*—happily a minority—in the struggle for existence should at times cruelly feel pinching want, when upon them must fall the evil of the barely sufficing aggregate or scarcity, the ideal creation which the self-interested producer strives for?

It has been shown that the supply of wants is at present alone roughly predetermined by the self-interested calculations of producers, and that their aim is to extend the field of production as far as they can in safety to themselves; and that means as near an approach to a full supply as will ensure good prices, involving a tight market, or scarcity. Consumers who desire abundance do not determine the forthcoming supplies. Producers' interests, therefore, are antagonistic to any social ideal which would bring the highest quota of necessary satisfactions easily within the reach of all men. Therefore, so long as producers' self-interest rules supreme in the creation of necessary products, so long must we expect the periodic suffering and pinching of the lower stratum of the working classes.

Food, clothing, houses, railways, steamboats, and the various machines of production, are almost wholly regulated in the interests of producers; competition alone preventing this interest from working in too great antagonism to the interests of *consumers*. Nearly all breadwinners, therefore, in detail defeat to some extent their own ultimate interests as general

* Bastiat even is forced to admit that "antagonistic desires cannot at one and the same time coincide with the general good." . . . . "As a purchaser he desires abundance; as a seller scarcity . . the wishes and desires of the *consumers* are those which are in harmony with public interest."

consumers, by regulating the production of supplies upon a principle which is inimical to their interests as consumers. Nor is this the only evil. All wages—breadwinners must produce, or serve to produce, before they can earn the right to share or consume the fruits of production. But the *number of those actually employed* depend almost wholly upon the *self-interest* of the *large capitalist producers.*

It is not the interest of large capitalist producers to provide the full quota of wage-earning employment to *all* breadwinners. The larger the number of fully employed labourers the keener is the demand for products, and indirectly this may have some influence upon certain producers. But this indirect consideration is too feeble to interest producers in any scheme for the general good which might be directed to ensure full employment to *all* breadwinners. It is manifest, therefore, that in the present scheme of the division of labour there are two ugly defects. *First*—There is no interest intelligently organised to train and determine the occupations of the future breadwinners according to natural proportions. *Second*—The only existing agencies which determine the extent of employment are guided by a principle which has for its object neither the supply of the highest quota of satisfaction to consumers, nor the more needful provision for securing employment to all breadwinners. In the latter case competition, instead of befriending the wage-earner and dependants as consumers, operates all the more harshly upon the larger number who are handicapped in the race by aimless training, or no training, for the nature of services that might possibly be otherwise open to some of them.

Utopian Schemes of Socialists.

It is not a matter for surprise, therefore, that the mass of wage-earners should readily sympathise with every vague Utopian scheme of the Socialists, which holds out, however faultily, some promise or plan for dealing more effectually with the root difficulties which affect them most nearly, viz., security of employment; protection from over competition; shorter hours labour with more adequate remuneration; redistribution of wealth, etc., etc.

But it is needless to point out that before the redistribution of the aggregate of all forms of existing wealth of exchange (so-called) can be dealt with, it must be clear that this wealth consists of such forms as might effectually satisfy all the primary wants and comfort of human beings. That existing *wealth in exchange*, even if equally distributed, would fulfil this most necessary provision, is a pure assumption.

It has already been shown that a great part of the existing nominal wealth of exchange, largely owned by the rich,

consists of the mere *tools* and *instruments* of production, and that the real wealth, appropriated as consumable wealth or primary satisfaction, is already more widely and evenly distributed thán is generally supposed. Even under the most thorough Socialistic scheme this form of wealth would be far less generally distributed than at present; for, according to such a scheme, it would be wholly reserved in the hands of the Executive Government. It is utterly misleading to reckon upon the existing wealth of capitalists as a source for raising the quota of the real consumable and primary satisfactions. The only distribution possible in this respect would be the empty idea of part ownership. It is the increase to necessary current productions *designed for actual consumption* — material satisfactions — which alone can raise the average standard of primary satisfactions, and so dispose of material want, or poverty and distress. The question therefore arises. Suppose that such a scheme were practicable, would the producing energies of men be greater and more effective than under the Scheme of Competition, Liberty, Right of Inheritance, Property Right, or Individualism, as it is called? To be more effective in one essential it must utterly fail in the other. The workers must be trained and allocated to specific occupations in strict conformity to the amount and nature of the labour actually required to produce the primary satisfactions and comforts desired. Training for every specific occupation requires considerable time; but for the occupations of skill a large amount of time must be consumed in acquiring the necessary training, irrespective of question with regard to the unequal distribution of capacity.

Now on the basis of equality it may be easy to divide products; that, according to actual needs is simple enough, involving no insuperable difficulty. But what about the allocation to different employment? How can the easy, the refined, and the skilled occupations be allocated on any scheme of equality? The majority must, as heretofore, sweat at the hard and dirty forms of labour. But what power, or what plan can be devised which will enable any elective executive to doom once and for ever the majority of learners and workers to the hard and irksome occupations, and to fix the minority in the refined, the easy, and skilled services?

Suppose it were for a time instituted, how long would the unfortunate majority be content to submit to their lot before an irresistible cry for *redistribution of occupations* arose; and if it arose, where is the force stronger than the majority of freemen to prevent the breakdown of the social organisation necessary to produce the supply of primary satisfactions according to individual needs? What compensation can be given to the masses toiling in the more wearisome occupations? Extra

allowance of satisfactions cannot be thought of, for that would destroy the coveted ideal of equality in the distribution of satisfactions according to needs. Shorter hours cannot be allowed without trenching upon equality of leisure.

The unequal distribution of natural capacity, and the time necessary to acquire knowledge of more than one technical branch of skilled employment, make it impossible to share in turn for a time all possible forms of labour. In short, the practical difficulties standing in the way of *equality* in the *allocation of employments* appear to be insuperable, and would most certainly, if there were no other objection, destroy any social organisation on a *large scale* which had been courageous enough to attempt it. Reference to simple communities—as in America—following agricultural pursuits mainly, and not of themselves fulfilling for themselves the whole round of human wants, are utterly misleading. Such small communities are composed of a peculiar select class, who voluntarily bind themselves to a more or less ascetic life, and all such partial attempts tend to perish from lack of internal vitality. With a large mixed body of men embracing all occupations and endowed with ordinary passions and desires, the results would be chaotic and disastrous in the extreme.

One effect, terrible to contemplate, would seem to be inevitable, viz., that the indiscriminate distribution of products among all men would destroy the major source of savings at present so largely devoted to the creation and maintenance of the powerful and costly auxiliary aids to human labour; and the slight individual gain per head in material satisfaction would only be of a very temporary character, for it would soon be lost by the new impulse given to the improvident to rapidly increase their numbers.

What Would be the Probable Effect Upon Social Well-being if the Major Source of Savings were Destroyed?

In another place it has been indicated that the mere "two-hands," or the unaided labour of man, would not only fail to produce the average comforts and luxuries now enjoyed by nearly all classes of men, but more calamitous still—they would fail to produce the *prime necessaries* of life in sufficient quantity to maintain the lives of the existing population. Defects in the existing scheme of civilisation—some of which seem to be ineradicable—may be truly charged yearly with the destruction of thousands of valuable lives, but were the present major source of savings dissipated or destroyed by equality in share of earnings—either by lowering the powers of production, or by *slightly raising temporarily* the average

amount of satisfactions *consumed or enjoyed*—the new conditions (equality of earnings) would be a blight and a curse; for while the existing defects in distribution may be the cause of the misery and destruction of thousands of valuable lives, the *equality* scheme would certainly entail the misery and destruction of millions now living in a state of comparative comfort.

Many who fail to ponder upon these root difficulties may exclaim:—How can you explain this paradox? Why should the fairer distribution of wealth (that according to actual, individual needs, without regard to inequalities of natural powers, capacities or inheritance,)—raising the average comfort of the majority, and lowering the superfluous and luxurious satisfactions of the minority—be productive of such disaster? The answer is plain enough. The power to effect large savings or to create the more costly auxiliaries of labour depends mainly upon the existence of specially favourable conditions.

1. The desire to accumulate or save can only become strong enough to be effective when the stronger desires for primary satisfactions are appeased.

2. Savings or accumulations, therefore, can never be produced by labourers or others whose earnings do not exceed the supply necessary to satisfy the three primary wants. The majority of breadwinners are always in this hand to mouth condition, and rarely of themselves are able to contribute to the maintenance and increase of machines and instruments to serve as auxiliaries of production to future labour. They, however, in their social relations more than contribute the average share of the future surplus workers whose efforts must be proportionately supplemented by capital and power-multiplying instruments, if they are to enjoy the same or a further improved condition.

Those workers whose earnings are sufficient to provide comforts beyond the limits of bare prime necessaries, may, however, by self-denial in the satisfactions of *comforts*, lay by a small store of savings, which in time may swell into such valuable auxiliaries to earnings, that the self-denial in *comforts* hitherto may be rewarded in the greater satisfaction of comforts in the future, and even add considerably to the store of wealth which may be converted into the more permanent capitalised auxiliary instruments of power which will benefit the generations coming after them.

Those, however, who contribute most largely to the creation of the permanent instruments which add unknown power to the efforts of hand labour, are chiefly those who either have inherited these or similar creations from their ancestors, or who by extraordinary energy, skill or self-denial, or all

together, in the earlier part of their lives, are now enabled, after satisfying the three primary wants and comforts, to indulge the prevailing passion of comfortable people, *i.e.*, the accumulation of wealth or power over wealth. This passion in itself is at this stage undoubtedly a personal luxury; but, unlike the luxuries which are directed to greater *personal consumption*, it is fortunately directed to that form of immaterial enjoyment which springs from the knowledge that the owner possesses the power to direct the mode, or secure the best conditions in which wealth may be further employed. Fortunately for the world at large, self-interest at this stage converts into a virtue what otherwise would be a vice: for the passion to further secure the luxury of power over wealth, and to augment it, restricts personal indulgence in further consuming the *material fruits of labour and the material gratuitous stores of nature*, and runs parallel with that course which favours increased production relative to numbers, involving the improvement of the social and economic condition of all labourers; *i.e.*, the wealthy man or industrial chief does not, or cannot, increase his own personal consumption of the *material* fruits of labour, skill, enterprise and the gratuitous gifts of nature beyond a moderate standard: the unconsumed material surplus—by passion, self-interest and even the better motives—is necessarily devoted to multiplying and sustaining the inanimate, costly, and powerful permanent aids to human productive power, which alone distinguishes civilised populous communities from those of the miserable and bare-handed savage, whose command of a continent of the richest land upon the globe is too feeble to support in comfort a few insignificant wandering tribes.

Anterior Savings the True Source of Capital Invested in the Creation and Distribution of Necessary Satisfactions.

Capital invested in land, railways, ships, canals, mines, mills, etc., and all labour-aiding machines and instruments devoted to the production and distribution of man's satisfactions, are the fruits of that portion of the products of *anterior labour* saved from the actual earners' consumption, and devoted or transformed into permanent and powerful skilled auxiliaries of *present labour*; and consequently it is an error to assume, as many do, that such forms of capital are the fruits of the major part of *anterior labour* already absorbed in current personal consumption.

That is—the capital in machines and instruments now devoted to production and distribution is derived from the *saved* products of anterior labour engaged in production,

and not from the efforts of such labour necessarily absorbed in sustaining the said labourers. It is true in one sense that all products, whether saved, transformed, or consumed, are obtained by means of labour; but it is equally true that only a minor portion of the products of labour is yearly devoted to fixed instruments to act as auxiliaries to future labour; and this minor portion is *wholly* derived from products of labour and skill *saved* from immediate destruction or consumption, and skilfully applied or directed to the creation of fresh auxiliaries to labour.

It follows from these considerations that existing capital so applied is *wholly* derived from *providential savings and skill*, and that only labourers who have contributed to these savings—with their natural representatives (inheritance)—have any real claim to a corresponding right to its *present* utilities and fruits.

Savings may be effected in various ways. They may be effected by greater industry: by the devotion of former savings to appliances aiding production: by increase of skill: by curtailing enjoyment in the consumption of satisfactions beyond *primary needs* or by a combination of all these: thus:—

Let I = Industry or energy expended.
K = Skill.
A = Skilled appliances or aids, the fruit of anterior providential savings.
C = Actual current consumption.
S = Current savings.

Then I K A – C = S or current savings.

So long as C or current consumption absorbs all the powers of I K A there can be no savings. When C exceeds I K A, debt, pauperism, crime, or death, may be the result.

When I K A exceeds C there must be prosperity and augmentation of the powers for producing more wealth.

The maximum savings are effected when I K A are at the maximum (^{m}) and C is at the minimum (^{u}) necessary to secure the satisfaction of primary wants: thus:—

$I^{m} K^{m} A^{m} - C^{u}$ = Maximum of savings.

But if the power of C to waste, destroy, or consume the results of I K A be indefinitely increased say to (^{x}) power there may be no balance or savings: thus:—

$I^{m} K^{m} A^{m} - C^{x} = O$ Savings.

That is, the stage of no savings is produced by the absorption or consumption of a very great amount of luxurious satisfactions.

But this state of *no savings*, or the minimum of savings, may be and is more frequently the result of the diminished (^{n}) powers of I K A with the minimum of C, or minimum stage.

$I^n K^n A^n - C^n = O$ Savings.

We have here four or five important conditions affecting the appropriation of the fruits of industry, skill, and skilled auxiliary appliances and aids.

(1) $I^m K^m A^m - C^n =$ { Minimum of satisfactions and maximum of savings.

$I^n K^n A^m - C^n$ (2) or $I^m K^m A^m - C^x =$ { Maximum of satisfactions and no savings.

(3) $I^m K^m A^n - C^n =$ { Minimum of satisfactions and increase of savings.

(4) $I^m K^m A^n - C^m =$ { No savings, and poverty.

(5) $I^n K^u A^n - C^n =$ { No savings, and poverty.

The first group is composed almost entirely of rich capitalists possessing skill, energy, and living moderately or abstemiously.

The second group is composed of rich capitalists possessing skill and energy, but living in extravagance.

The third group is composed of skilled minds and hands, middlemen, professional men, and better class of skilled labourers living moderately within their means.

The fourth group, the same as the last, but living up to their means, or lacking skill or energy.

The fifth group is composed of unskilled workmen lacking industry or lacking employment, or skilled workmen lacking energy or employment, or improvident in their manner of living.

Whatever defects spring from riches there is this to be said in its favour: that by passion for accumulation or savings of its owners it secures the necessary fund to invest in the expensive tools and instruments of production, without which the primary wants of the existing population could not be supplied. The desire to sacrifice present ease to future benefit is confined to the few, and if the products were generally distributed in equal proportion they would be almost entirely lost by slightly raising for the moment the average consumption of satisfactions; and this slight advantage would soon be dissipated by the impulse which it would give to the masses of improvident persons—in heightening the marriage rate, and causing a rapid increase of population or mouths to be fed.

FALLACIES OF THE SINGLE TAX PANACEA.

Mr. Henry George's name among modern writers stands pre-eminent in the advocacy of the abolition of the existing modes of levying taxes mainly derived from land and property, luxuries, and foreign products, and substituting for the same a direct tax upon the value of the land,* minus such *tangible* artificial additions to its value that may be truly estimated as *improvements* solely created by the labour or services of man. Waiving the serious objection at the threshold of this proposal, viz., the difficulty—nay the impossibility—of justly determining the proportional values of the *land* and the *improvements* added to it by *man's services*. Let us examine it fairly in the light of the various CANONS OF TAXATION which Mr. George himself quotes with approval: Thus p. 63 (People's Edition) "Progress and Poverty," he affirms:—

"The best tax by which public revenues can be raised is evidently that which will closest conform to the following conditions:—

"1. That it bear as lightly as possible upon production so at least to check the increases of the general fund from which taxes must be paid and the community maintained.

"2. That it be *easily and cheaply collected and falls as directly* upon the ultimate taxpayers, so as to take from the people as little as possible in addition to what it yields the Government.

"3. That it be certain, so as to give the least opportunity for tyranny and corruption on the part of officials and the least *temptation to law-breaking* and evasion on the part of the taxpayers.

"4. That it *bear equally*, so as to give no citizen an advantage or put any at a disadvantage as compared with others."

THE EFFECT OF THE SINGLE LAND TAX UPON PRODUCTION.

Mr. George asserts without the slightest attempt to show by argument or demonstration that "Taxes on the value of land not only do not check production, as do most other taxes, but they tend to increase production by destroying speculative rent." This, certainly, is one of the most absurd and fallacious assumptions that could be made, and yet, without reason or argument, Mr. George supposes that we can at once build upon this rotten foundation without question or hesitation. He evidently thinks that different *names* for the same thing have some occult power to alter the

* That means in practice a tax upon local products in lieu of a tax upon foreign products.

inevitable effects due to the thing *per se*, and not to the name applied to it. This is the fault of all visionary theorists. Let us brush away the thimble-rig of words and terms, and come at once to plain practical issues. No person can become a successful primary producer among other primary producer-competitors, unless he possesses the necessary capital and speculative skill. There is no business so uncertain in its results as farming, both as regards total income and total expenditure. More especially do these uncertainties apply to the enterprising farmer, who ventures into the speculation of entering upon virgin bush land with the view of earning a living for himself and his family ultimately from the profits derived from the sales of cultivated *products*. This profit consists entirely of the margin which the aggregate of his yearly *revenue* from sale of products shows above the aggregate of his yearly *expenditure*. It is the *amount* of the several items of *revenue* and *expenditure* which determines his *profit* or his *loss*, and not the specific nature of the various items of *revenue* and *expenditure*.

All items of expense, including profit, must come out of products, or he will speedily become bankrupt and cease to be a producer. Consequently, all products embody *all charges*, whether interest, mortgage, rent, tax, wages, other working expenses, and cost of farmer's own services as director and speculator, viz., *profit*.

Rent Versus Single Tax.

Rent adjusts itself to the producing capabilities of the land. But a single national tax upon the land would be likely to prove a more formidable check to the cultivation of the soil or local production than the most heavy form of rent.

Rent is admittedly determined by the average margin left from the *sale* of products, after giving the working expenses of the farm *plus* the minimum profit to the working farmer. It cannot seriously affect production without destroying itself, and hence it must accommodate itself to the said margin, even though it should fall to rent zero. The latter stage, if reached, might check production, but so long as any margin remained production would be determined by the capabilities of the land and the enterprise and skill of the farmer. There is, therefore, no predetermined charge *fixed in character*, forming a charge on production in the shape of rent. On the contrary, it fluctuates in time in correspondence with the revenue yielded from the sale of its products. Rent rising, with relative improvement, either in price of products or with relative decrease in the cost of working the farm, due to

improved machines or methods of cultivation; rent falling with the reverse of these conditions. On the whole, therefore, rent, interest, mortgage, and working farmers' share of profit resolve themselves into mere sub-divisions of the total profit due to farm speculations drawn from sale of products, the balance of sale of products being absorbed by wages and miscellaneous expenses of working, all entirely governed by, and not exceeding, the total revenue of products, the amount of which is regulated by the local competition of similar goods that may be conveyed in any market from foreign as well as local sources. It is absurd, therefore, to suppose that a *tax* upon land does not enter into the ultimate cost of the product just as surely as the items of charge known under the names of interest, mortgage, wages of farm servants, profit of farmer; for as soon as the prices governed by local and foreign competition fail to cover *all* the items of expenditure and minimum of profit, so soon will a *check* appear to Production, so far as the land which is so effected is concerned. There is no trick of words about this result. Every practical farmer knows it too well, although he may not understand the word-splitting and theory-chopping of some speculative Economists. Thus, with average energy and skill, if the produce per year of a grain farm at current prices only covers the minimum of wages and ordinary working expenses, and minimum of profit to farmer by £50, then such farm could only yield that sum for all other charges, whether tax, rent, mortgage, or interest. It is immaterial to the farmer whether the charges be distributed over all these items thus:—

	£	s.
Tax	12	10
Rent	12	10
Mortgage	12	10
Interest	12	10
Total	£50	0

Or simply thus:—

	£
Tax	50
Rent	*nil*
Mortgage	*nil*
Interest	*nil*
Total	£50

The effect upon production, producer, and consumer would be exactly the same. If this sum of £50 could be disposed

of altogether it would be possible for the farmer to reduce to that extent the price of products to consumer, but the consumer must necessarily pay for it so long as it remains a charge either as tax, rent, interest, or mortgage. It is the *amount* remaining as a *charge* that concerns the producer and the consumer, and not the *nature* or *name* of the item forming the said charge.

So long, therefore, as foreign products are not artificially excluded from local markets the consumer is perfectly secure against the monopolists of local rents raising the price of products by arbitrary increases to rent.

But a very different conclusion must be arrived at if rental and other charges, such as interest or mortgage, are abolished, and merged in the shape of a single tax upon land. In the first place, if we abolish all burdens on land in the shape of rent or mortgage—How are we to do so? In these colonies at least, the right to the rent of land has been acquired by honest purchase. Even now the State in Tasmania derived (in the year 1888) a revenue of £77,504 from rental and fresh sales of land; a sum equivalent to 19·09 or nearly 20 per cent. of the total yearly taxation. In the 10 years ending 1888 the State derived a revenue of £646,497 from the same source: and yet after taking from honest purchasers this original value of the land, Mr. Henry George and his followers would urge upon the State to retain the original purchasers' money, and wrest from them all rights in land thus acquired without compensation. Such a proceeding would be revolting to all who possess any remaining trace of the sense of honour. The hypocrisy of glossing over such wholesale robbery by any fine-sounding phrase only shows how far the modern robber has fallen from his ancient prototype, who, at least, had the courage to consent to an appropriate name for his violence and dishonesty. We have no representatives of feudal lords in these colonies, and if we had, the proprietors of the land for the time being are as much and as little their representatives as any other capitalist; for every year a considerable portion of the land changes hands by fair purchase, and there are now few owners of land who can trace their land to the State by purchase or grant, who have not parted with it on fair terms of purchase to those who amassed wealth from other sources of wealth and enterprise. The condition of society, if it is to be improved, cannot be ameliorated by State robbery or violence. There is, therefore, only one honourable course for the Single Tax theorists to adopt, viz., to compensate the existing owners for the loss of their rightly acquired property. This course would involve capitalising the land. Now, supposing this to be done, and that we made some profit

by borrowing, say, at 3½ per cent. (allowing that the revolutionary scheme has not the immediate effect of destroying our credit), what would be the sum to provide for?

The last estimate of private property is stated to be £21,386,848, and it will be near enough the mark to state that 40 per cent. of this value refers to land *minus* improvements. This represents a capital sum of £8,554,739. Even if we raised this sum at 3½ per cent. par, it would increase our existing charge for interest on debt by £299,415.

Single Tax fixed in character determined by the needs for public expenditure without regard to the capabilities of the land or to its power to sustain the burden so imposed.

But if we are to meet the demands of public expenditure we must concentrate all the other modes of raising revenue from taxes and land sales in one single tax or burden upon the land. At present the revenue raised in this way in Tasmania amounts to £455,027 *per year*. If to this we add the fresh charge for land transfer to the State, the tax upon land would be necessarily raised to £754,443. The present value of the annual rateable value, *minus* improvements, is estimated to be £440,800. It would therefore follow that the direct burden upon land would be raised £313,643 *per year*, or 71 per cent. above the burden now imposed upon it by way of rent; or if we take the land and improvements, it would mean an increase of 28·45 *per cent.* on land and its improvements above the burden at present imposed due to rental. It is true there would be some set-off to this in the abolition of other forms of taxation, at present mainly derived from the luxurious consumption of spirits and tobacco, etc., averaging £2 16s. 2d. *per head* per year, or £6 5s. 8d. per *breadwinner*, £11 4s. 8d. per family of four persons, or £14 13s. 10d. per *household*.

But it must be borne in mind that at present the taxes actually paid by any one individual, by an inevitable law, is adjusted to the means of the individual. For example, the large part of the necessaries of a poor man is not taxed—bread, meat, vegetables, and such like—and even on the taxable articles the amount of tax is proportionate to the amount the individual is enabled to expend upon taxable articles, principally drink and tobacco. A non-drinker and non-tobacco smoker, therefore, at his own pleasure, escapes the greater part of the State tax. In this way any person, by the present mode of taxes, need in case of distress, pay only a very small portion of his income in taxes.

But in the case of a single tax upon land (ground rent) the poor man in a four-roomed weatherboard hut might have to pay the same amount of tax as his rich neighbour in a fine

house. Thus take the following possible cases :—

	Capital Value		Annual Rent of House	The same as affected by Land Tax		Annual Rent of House	In-crease.	Per Cent.
	Land	House		Land	House			
	£	£	£	£	£	£	£	
A	200	2,000	110	342	2,000	117	7	6·3
B	200	1,500	85	342	1,500	92	7	8·2
C	200	1,200	70	342	1,200	77	7	10·
D	200	1,000	60	342	1,000	67	7	11·6
	200	500	35	342	500	42	7	20·
F	200	300	25	342	300	32	7	28·
G	200	200	20	342	200	27	7	35·

Land 40ft. frontage on street same Block.

Thus, if the total rental be a fair index to the means of each tenant, the table shows that the effect of the single tax in adding £7 alike to rich and poor, would be only a relative tax to the rich (*a*) of 6 per cent., while to the poor (*g*) it would be equal to an increase of 35 per cent. Thus it would appear that the single tax would violate the most valuable canon of taxation, —8, (Adam Smith.) "The subjects of every State ought to contribute towards the support of the Government as nearly as possible in proportion to their respective abilities." When we consider also that if the farmer is able to add the increased burden of 28·45 per cent. to his products (and if he fails by foreign competition to do this, he can no longer carry on the farming industry in Tasmania), we must also add 28·45 per cent. to all products of Tasmania which the poor man's family consumes, we perceive at once that *the single tax scheme would mainly fall with cruel severity upon the poor man*, and thus the scheme instead of a boon would be a curse to him, and perhaps check half or most of our great producing industries. If our principal industries were checked it would operate at once in throwing a great part of the population out of employment. Even if it only curtailed a labourer's employment by 10 per cent. it would have the effect of reducing his wages (at 6s. per day) by 0·92 pence, nearly a 1d. per hour: while if the whole land rental were directly distributed among workmen yearly it would only have the effect of raising their wages by 0·679*d.* or only 2-3*rds of a penny per hour*.

As regards the supposed effect of decreasing the cost of collecting revenue, and preventing fraud, it would have the opposite effect. Collection by Customs in Tasmania only represents 2·8 *per cent.* of the total revenue collected, as against a charge of 5 *per cent.* for collection of Real Estate Duties and Police Rate.

Thus the whole of the canons of taxation cited by Mr. George would be violated by any single tax proposal.

FURTHER OBSERVATIONS UPON THE FISHES AND FISHING INDUSTRIES OF TASMANIA, TOGETHER WITH A REVISED LIST OF INDIGENOUS SPECIES.

By Robt. M. Johnston, F.L.S.

It is now about eight years since my first Catalogue of the Fishes of Tasmania was presented by me to the members of this Society. Since that time I have occasionally published an account of other species not embraced in my original list. Messrs. A. Morton, F.L.S., and Saville-Kent, F.L.S., have also made two or three interesting contributions, and have added considerably to our knowledge of the indigenous fishes of the island. In this way the 188 species then known have increased to 214 species. As it is desirable that a fresh catalogue should be prepared, embracing all the species known at the present time, I have much pleasure in submitting the following additional observations regarding our fishes and fishing industries, together with a list of the principal edible fishes, and a complete classified list of all the fishes known to me at the present time.

The Tasmanian student has now also the great advantage of reference to the splendid "Catalogue of Australian Fishes," prepared by the Hon. William Macleay, to whom the author acknowledges himself greatly indebted for valuable guidance and information.

FISHES.

The known sea and inland fishes of Tasmania, including the eight species of European fresh-water fishes successfully acclimatised, number 214 species. These are generally grouped by naturalists under 4 sub-classes, 65 families, and 146 genera. About one-third of the number stated may be considered good edible fish, although only about 21 species are caught in sufficient number to form a market supply. The following are the local names of those found in greatest abundance, the first six alone forming articles of export*:— The Hobart Trumpeter, Perch *(Chilodactylus)*, Snotgall Trevally, Barracouta, Kingfish, Conger Eel, Native Salmon,

* For further particulars regarding Natural History and Classification, see Report of the Tasmanian Fisheries Commission, 152 pp., 1882; and General and Critical Observations on the Fishes of Tasmania, with a Classified Catalogue of all the Known Species, by the Author (Proc. Roy. Soc. of Tasmania, 1882).

Bastard Trumpeter, Red Perch, Rock Gurnet, Flathead, Horse Mackerel, Sea Mullet, Rock Cod, Ling, Flounder, Sole, Garfish, Common Eel.

The first of these, the Hobart Trumpeter, is undoubtedly the king of Tasmanian Fishes, and is generally esteemed as the finest of the Australian edible fishes. It commands a high price and ready sale in the local market as well as in the neighbouring colonies; but, unfortunately, although captured in considerable numbers all the year round, it is very limited in its distribution, being confined to certain coral reefs or banks 10 to 70 fathoms deep fringing the southern coasts of Tasmania between Granville Harbour in the west and Seymour in the east.

The Barracouta, Kingfish, and Rock Cod appear periodically in such vast numbers that frequently the supply is greatly in excess of local demand. Owing to the absence of proper fish-curing establishments, large quantities have, at times, been known to be wasted or merely utilised as manure.

It is known also that large schools of Sand-smelts, Sprats and Anchovies appear upon our coasts at regular seasons, but, for the reasons already mentioned, and because the fishermen lack the proper appliances in the shape of *Pilchard Seine* nets, no attempt hitherto has been made to open up an industry in this particular direction.

Trawl-nets have been tried on the coast, but without good result. Either the class of bottom fish is absent in our waters, or the proper grounds have yet to be discovered suited for this mode of capture.

Besides the fishes proper, the fishing industry is largely dependent upon the capture of a fine species of Crayfish (*Palinurus Edwardsii*), which often weighs, when mature, from 6 to 7lbs. It is estimated that there are over 280 tons of this highly prized Crustacean brought to market yearly, including those exported to Victoria and New South Wales, but excluding those used for baiting purposes and those captured by Victorian boats. There is also a small Prawn taken in considerable quantities during the season in the River Tamar. They abound all round our coasts, but little attention has been devoted to them anywhere on the coast beyond the River Tamar.

Of Molluscs there is only one of any importance,—viz., the Common Mud Oyster. Although not now abundant, it is estimated by competent authorities that about 20 years ago the various beds yielded about 44,000 bags, or 22,000,000 oysters per year.

The destruction of these once prolific Oyster beds have engaged much attention. Although attributed generally to reckless unrestricted dredging, continued until the greater number of the beds were wholly destroyed, it is believed by

some that natural causes were operating concurrently with the causes alleged. Attempts have recently been made to extend the cultivation of the Oyster in the old habitats with great promise of success. Natural conditions again seem to be working round in favour of the development of the Oyster. The prolific fall of Spat during the last two or three years in the natural beds at Cole's Bay and Little Swanport, and their rapid growth there, promise well for the future of the new centres where artificial beds are laid down, at Spring Bay and elsewhere.

The following is a more extended List of the Edible Fishes brought to market in more or less abundance, according to the kind and season:—

LIST OF THE PRINCIPAL EDIBLE FISHES IN TASMANIAN WATERS.

[a]Abundant all the year round. [b]Abundant during the season.
[c]Common all the year round. [d]Common during the season.
[e]Not uncommon ditto. [f]Not uncommon ditto.

Percidæ (Perch Family).

Anthias rasor	*Red Perch*[d]	Season, winter.
Lates colonorum	*Brackish Water Perch*[a]	Confined to Anson's River.
Arripis truttaceus	*Native Salmon*[a]	Periodically enter estuaries in schools.

Sparidæ (Bream Family).

Girella tricuspidata	*Black Bream*[d]	Season, October to March. C. Australis enters brackish water lagoons and mouths of rivers for spawning purposes.
" simplex	*The Sweep*[d]	
Chrysophrys Australis	*Silver Bream*[d]	

Cirrhitidæ (Trumpeter Family).

Chilodactylus Allporti	*Carp*[d]	Season, January to March.
" macropterus	*Perch*[a]	Height of season (mature), April to August. The most excellent of all Tasmanian fish. Sometimes reaches a weight of 60lbs.
" vizonarius	*Magpie Perch*[f]	
Latris hecateia	*Trumpeter*[a]	
" Forsteri	Silver Bastard[b]	Abundant during season, January to March Rivals the Real Trumpeter at this stage.
	Red Bastard[a]	Immature form; good, but not equal to mature form.
Mendosoma Allporti	*Real Bastard*[e]	

SCORPÆNIDÆ (Gurnet Family).

Sebastes percoides	*Rock Gurnet*[c]	Found on the outer reefs.

TRICHIURIDÆ (Barracouta Family).

Lepidopus caudatus	*Frostfish*[f]	Caught at odd times—winter.
Thyrsites atun	*Barracouta*[b]	Important food fish. Caught in vast numbers, November to August.
" Solandri	*Kingfish*[b]	Season, December to June. Come and go in vast numbers, but disappear in some years altogether.

CARANGIDÆ (Horse Mackerel Family).

Trachurus trachurus	*Horse Mackerel*[b]	Season, Jan. to April.
Caranx Georgianus	*Silver Trevally*[b]	Enter Tamar and other rivers, midwinter.
Seriola grandis	*Tasmanian Yellow-tail*[b]	Abundant Northern Coast, March to April.
Neptonemus brama	*Snotgall*[b]	Season, March to April.
" dobula	*Mackerel Trevally*[b]	Ditto, entering estuaries in large schools.

CYTTIDÆ (Dory Family).

Cyttus Australis	*Bastard Dory*[d]	Enter estuaries in schools, but seldom captured.

TRACHINIDÆ (Whiting Family).

Uphritis Urvillii	*Sandy*[a]	Abundant in the River Jordan and East Coast rivers.
Sillago ciliata	*Whiting*[d]	One of the most delicious fishes in our estuaries.

COTTIDÆ (Flathead Family).

Platycephalus Bassensis	*Common Flathead*[a]	A very fine fish, though repulsive looking. Abundant on sandy bottoms.

ATHERINIDÆ (Silver Belly Family).

Atherina presbyteroides " hepsetoides " hepsetus " microstoma " Tamarensis	*Silver Bellies*	These little fishes are found everywhere in vast shoals. Although seldom exceeding 5 inches long, they form a delicious article of food. No trouble is taken to capture them for market.

MUGILIDÆ (Mullet Family).

Mugil cephalotus	*Sand Mullet*[d]	Excellent fish. Found on the northern and eastern coasts.
Agonostoma Forsteri	*Estuary Mullet*[a]	Caught chiefly by hand-rod, in large numbers.

LABRIDÆ (Parrot Fish Family).

Cossyphus cerulæus	*Blue Head*[a]	Abundant, and although good food, it is not brought to market.

GADOPSIDÆ (Blackfish Family).

Gadospis marmoratus	*Freshwater Blackfish*[a]	An excellent fish, peculiar to our northern rivers.

GADIDÆ (Cod Family).

Pseudophycis barbatus	*Rock Cod*[a]	Excellent fish, well suited for smoking. Very numerous during winter.

OPHIIDÆ (Ling Family).

Genypterus blacodes	*The Ling*[e]	Very fine fish.

PLEURONECTIDÆ (Flounder Family).

Rhombsolea monopus	*Flounder*[a]	Excellent table fish.
Amnotretis rostratus	*Sole*[e]	Abundant in some estuaries.

SALMONIDÆ (Salmon Family).

Retropinna Richardsoni	*Whitebait or Smelt*	Enters estuaries in large shoals. Though only 3 to 4 inches long, they are very delicious

Salmo salar	The Salmon	These valuable fishes have all been successfully introduced from the United Kingdom. The three last species are very abundant now in our rivers and seas. The Brown Trout sometimes reaches a weight of 32lbs.
" trutta	Sea Trout[b]	
" fario, *v.* Ansonii	Brown Trout[b]	
" fontinalis	American Trout[b]	

HAPLOCHITONIDÆ (Grayling Family).

Prototroctes mar-æna	*Cucumber Mullet*[b] *or Grayling*	This fine little fish is the most delicious of our freshwater fish. It is found abundantly in the Mersey and northern and western rivers. Affords excellent sport to anglers

GALAXIDÆ (Jolly-tail Family).

Galaxias truttaceus	*Spotted Trout*[a]	Small fish, very abundant in all our streams Excellent for the table and caught readily by rod and line
" attenuatus	*Jolly Tail*[a]	
" auratus	*Golden Trout*[e]	Largest form, Lake Sorell.

SCOMBRESOCIDÆ (Garfish Family).

Hemirhamphus intermedius	*Garfish*[b]	Excellent fish for the breakfast table. Season, April-October.

CLUPEIDÆ (Herring Family).

Engraulis encrasicholus	*Anchovy*[b]	Enters estuaries in large numbers during summer.
Clupea sprattus	*Sprat*[b]	Great shoals, Aug.-Nov.

No attempt has yet been made to utilise these valuable fishes, owing to the absence of appliances and to the lack of enterprise in the shape of fish-curing establishments.

MURÆNIDÆ (Eel Family).

Anguilla Australis	*Common Eel*[a]	No proper appliances exist for the capture of these valuable fish.
Conger vulgaris	*Conger*[a]	Valuable market fish, sometimes attains a weight of 40 lbs.

Sharks of various kinds are abundant, and although the smaller forms, such as Mustelus, are edible, they are not utilised as food.

Galeus canis (Dog Fish) is captured largely in certain localities, and the liver is boiled down for oil. The fishermen also largely use the flesh of "Gummies" and "Dog Fish" as bait for the deep-sea Trumpeter fishing.

The following is a classified synopsis of all the known Fishes of Tasmania, embracing 65 families, 146 genera, and 214 species:—

SYNOPSIS OF TASMANIAN FISHES OF ALL KINDS.

SUB-CLASS TELEOSTEI.

Family.	Genera.	Species.	Examples.
Percidæ	12	13	Red Perch, Native Salmon
Squamipinnes	1	1	Scorpis
Mullidæ	1	1	Red Mullet
Sparidæ	4	5	Bream, Schnapper
Hoplognathidæ	1	1	Hoplognathus
Cirrhitidæ	5	14	Carp, Perch, Trumpeter
Scorpænidæ	5	7	Gurnet, Soldier
Berycidæ	2	2	Nannegai
Kurtidæ	1	1	Pempheris
Sciænidæ	1	2	Maigre
Xiphiidæ	1	1	Swordfish
Trichiuridæ	2	4	Barracouta, Kingfish
Carangidæ	5	8	Horse Mackerel, Snotgall
Cyttidæ	2	2	Bastard Dory
Scombridæ	5	5	Mackerel, Pilotfish
Trachinidæ	5	6	Catfish, Whiting
Pediculati	1	2	Handfish
Cottidæ	3	5	Flathead, Flying Gurnard
Gobiidæ	2	2	Goby
Gobiesocidæ	1	1	Gobiesox
Blenniidæ	6	8	Blenny, Bully
Sphyrænidæ	2	2	Jack, Pike
Atherinidæ	2	6	Sand-smelt, Silver Belly
Mugilidæ	2	2	Mullet, Sand Mullet
Centriscidæ	1	1	Snipe, or Trumpet-fish
Gobiesocidæ	1	1	Crepidogaster
Lophotidæ	1	1	Lophotes
Trachypteridæ	2	2	Ribbon Fish
Pomacentridæ	1	1	Rock Perch
Labridæ	4	13	Blue Head Stranger, Parrot-fish
Gadopsidæ	1	1	Blackfish
Gadidæ	2	2	Rock Cod
Ophidiidæ	2	2	Ling
Macruridæ	2	2	Coryphæna
Pleuronectidæ	3	4	Sole, Flounder
Haplochitonidæ	2	2	Derwent Smelt, Freshwater Herring
Scopelidæ	1	1	Alepidosaurus
Salmonidæ	2	5	Salmon, Whitebait
Galaxidæ	1	5	Spotted Trout, Jolly-tail
Scombresocidæ	1	1	Garfish
Cyprinidæ	2	3	Carp, Tench
Gonorhynchidæ	1	1	Sand Eel
Clupeidæ	2	3	Anchovy, Sprat
Synbranchidæ	1	2	Chilobranchus
Muræindæ	4	5	Common Eel, Conger

Pegasidæ	1	1	Sea-dragon
Syngnathidæ	5	9	Pipefish, Sea-horse
Sclerodermi	2	12	Leather Jacket, Trunkfish
Gymnodontes	4	5	Toad Fish, Porcupine Fish
Total Teleostei (49)	121	186	

Sub-class CHRONDROPTERYGII (Sharks and Rays).

Sharks.

Chimæridæ	1	1	Elephant-fish
Carcharidæ	4	4	Blue Shark, Tope, Gummy
Lamnidæ	3	3	Porbeagle, Nurse, Thrasher
Notidanidæ	1	1	Tasmanian Blue Shark
Scyllidæ	3	4	Wobbigong
Cestracionidæ	1	1	Port Jackson Shark
Spinacidæ	1	2	Spiny Dog
Rhinidæ	1	1	Angel Shark
Pristiophoridæ	1	2	Sawfish

Rays.

Rhinobatidæ	1	1	The Fiddler
Torpedinidæ	1	1	Electric Torpedo
Rajidæ	1	1	Thorn-back Skate
Trygonidæ	1	1	Stingaree
Myliobatidæ	1	1	Whip-tail Ray
Total Sharks and Rays	21	24	

Sub-class CYCLOSTOMATA.

Petromyzontidæ	2	2	Lamprey, Pouched Lamprey

Sub-class LEPTOCARDII.

Cirrostomi	1	1	Lancelet

Summary.

Sub-class	Families.	Genera.	Species.
Teleostei	49	122	186
Chrondropterygii	14	21	24
Cyclostomata	1	2	2
Leptocardii	1	1	1
Grand Total	65	146	214

COMPLETE LIST OF TASMANIAN SPECIES.

SUB-CLASS TELEOSTEI.

Fam. PERCIDÆ. (13.)

Perca fluviatilis, *Rondel.* (I.) English River Perch.
Callanthias Allporti, *Gunth.* (T.) Allport's Perch. D. 11 : 10. A. 3 : 10. L. lat. 46.
Enoplosus armatus. Old Wife. D. 7 : 1·14-15. A. 3·15.
Anthias rasor, *Rich.* (A.) Red Perch : Barber. D. 10 : 21. A. 3 : 9. L. lat. 54. L. tr. 4 : 18.
Microperca Tasmaniæ, *Johnston.* (A.) Native Perch. D. 8 : 1·7-8. A. 3·8 : V. 1·5. L. lat. 28-30 : L. tr. 12.
Lates colonorum, *Gunth.* (A.) Brackish Water Perch. D. 8 : 1-10. A. 3·8. L. lat. 55. L. tr. 8 : 21.
Oligorus gigas, *Owen.* (A.) Hapuka. (T.Z.) D. 11 : 12. A. 3·8.
Eurumetopos Johnstonii, *Morton.* (T.)
Apogon Guntheri, *Cast.* A. Brackish Water Perch. D. 7 : 1-9 : L. lat. 26. L. tr. 11-12.
Apogon Lemprieri, *Johnston.* (T.) D. 6 : 1-10. A. 2·9. L. lat. 27. L. tr. 3-10.
Arripis truttaceus, *Cuv.* and *Val.* (A.Z.) Native Salmon. D. 9 : 16-17. A. 3 : 10. L. lat. 48-52. L. tr. 6 : 12.
Histiopterus recurvirostris, *Rich.* (A). Boar Fish. D. 9 : 15. A. 3·10-11. P. 18. L. lat. 130.
Erythrichthys nitidus, *Rich.* (A.Z.) D. 9 : 3 : 1·9-10. A. 5·10. L. lat. 96. L. tr. 8 : 20.

Fam. SQUAMIPINNES. (1.)

Scorpis Georgianus, *Cuv.* and *Val.* (A.) D. 9 : 26. A. 3 : 27.

Fam. MULLIDÆ. (1.)

Upeneus porosus, *Cuv.* and *Val.* (A.Z.) Red Mullet. D. 8 : 1-8. A. 7. L. lat. 30.

SPARIDÆ. (5.)

Girella tricuspidata, *Cuv.* and *Val.* (A.) Black Bream. D. 15·11-13. A. 3·11-12. L. lat. 50. L. tr. 10-11 : 20-23.
Girella simplex, *Rich.* (A.) The Sweep. D. 14-15 : 12-13. A. 3·11-12. L. lat. 55. L. tr. 11-12 : 20-23.
Haplodactylus arctidens, *Rich.* (T.) Marbled Kelp Fish. D. 15-16 : 18-20 : A. 3·7 : P. $\frac{10-9}{6}$
Chrysophrys Australis, *Gunth.* (A.) Silver Bream. D. 11 : 10-11. A. 3·8. L. lat. 44-45 : L. tr. 5 : 13.
Pagrus unicolor, *Cuv.* and *Val.* (A.Z.) Schnapper. D. 12·10. A. 3·8. L. lat. 52. L. tr. 8 : 17.

Fam. HOPLOGNATHIDÆ. (1.)

Hoplognathus Conwayii, *Rich.* Hoplognathus. D. 12 : 12. A. 3·12.

Fam. CIRRHITIDÆ. (14.)

Chironemus marmoratus, *Gunth.* (A.) Large Kelp Fish. D. 14 : 1-18. A. 3·6. L. lat. 55.

Chilodactylus spectabilis, *Hutton.* (T.Z.) D. 17 : 26. A. 3·6. L. lat. 55.

Chilodactylus Allporti, *Gunth.* T. Carp. D. 17 : 25-28. A. 3·9. P. 8·6. L. lat. 55-56.

Chilodactylus carponemus, *Park.* (T.) Great Perch D. 17 : 31-32. A. 3·17-18. L. lat. 64.

Chilodactylus macropterus, *Rich.* (A.) Black Silver Perch. D. 17-18 : 25-28. A. 3·12-14. P. 9·6. L. lat. 55 : 4-5. L. tr. 6 : 13-15.

Chilodactylus nigripes? *Rich.* Black Silver Perch. D. 18 : 26. A. 3·10. L. lat. 61. 5 simple pectoral rays.

Chilodactylus nigricans, *Rich.* (A.) Black Butter Fish.

Chilodactylus vizonarius, *Kent.* (T.) Magpie Perch. D. 17 : 26-33. A. 3·9-10. L. lat. 63. 6 simple pectoral rays.

Nemadactylus concinnus? *Rich.* (T.) Magpie Perch. D. 17 : 28. A. 3·15. L. lat. 50.

Latris hecateia, *Rich.* (T.Z.) Trumpeter. D. 17 : 1·36-38. A. 3·28-30. P. 9·8-9. L. lat. 100.

Latris Forsteri, *Cast.* (A.) Bastard Trumpeter. D. 16 : 1·37-42. A. 3·33-36. P. 9-10·8-9. L. lat. 115-120.

Latris ciliaris, *Forst.* (A.Z.) Moki. D. 17 : 39. A. 3·32. L. lat. 84. P. 6.

Latris Mortoni? *Kent.* (T.) Morton's Trumpeter. (Teeth on Vomer. L. lat. 110.)

Mendosoma Allporti, *Johnston.* Real Bastard. D. 23 : 1·25-26. A. 3·18-19. P. 15-16. L. lat. 72-74.

Fam. SCORPÆNIDÆ. (7.)

Sebastes percoides, *Soland.* (A.Z.) Gurnet. D. 11 : 1·12. A. 3·5. L. lat. 60-65.

Scorpæna cruenta, *Soland.* (A.Z.) Little Gurnet. D. 11 : 1·10. A. 3·5. L. lat. 45?

Scorpæna panda, *Rich.* (A.Z.) D. 12 : 1·8. A. 3·5. L. lat. 67.

Holoxenus Guntheri, *Johnston.* (T.) Velvet Fish. D. 8 : 5·10. A. 3·9. C. 12-13. V. 1·5.

Holoxenus cutaneus, *Gunth.* (T.) D. 7 : 3·10. A. 9. C. 12. V. 1·5.

Pentaroge marmorata, *Cuv.* and *Val.* (A.) Soldier. B. 7. D. 12-13 : 10. A. 3·6.

Glyptauchen panduratus, *Rich.* (A.) D. 17 : 7. A. 3·6. V. 1·5.

Fam. BERYCIDÆ. (2.)

Beryx affinis, *Gunth.* A. Nannegai. D. 7 : 12. A 4 : 12-13. V. 1 : 7. L. lat. 41-43. L. tr. 6 : 12.

Trachichthys Macleayi, *Johnston.* D. 5 : 13. A. 3·10. V. 8. L. lat. 50. 13 scutes.

Fam. KURTIDÆ. (1.)

Pempheris macrolepis, *Macleay.* (A.) D. 4-5 : 12. A. 3·33-36.

Fam. SCIÆNIDÆ. (2.)

Sciæna antarctica, *Cast.* A. Victorian Kingfish. D. 9 : 1·27. A. 2·7. P. 17. L. lat. 68.

Sciæna aquila? *Lacep.* (E.) Maigre. D. 10 : 1·26-27. A. 2·7. L. lat. 53.

Fam. XIPHIIDÆ. (1.)

Histiophorus Herschelli, *Gray.* Swordfish.

Fam. TRICHIURIDÆ. (4.)

Lepidopus caudatus, *White.* Frostfish. D. 102-104. A. 24-25.

Thyrsites atun, *Cuv.* and *Val.* Barracouta. D. 20 : 1-10 : VI. A. 1·10 : VI.

Thyrsites micropus? *M'Coy.* D. 17 : 4·12 : VI. A. 2·11 : IV. VI. 1. P. 14.

Thyrsites Solandri, *Cuv.* and *Val.* Kingfish. D. 17-18 : 1·17-18 : I-II. A. 1·13-18 : II. P. 14-15.

Fam. CARANGIDÆ. (8.)

Trachurus trachurus, *Cuv.* and *Val.* (A.Z.) Horse Mackerel. D. 8 : 1·32-35. A. 2 : 1·25-29. L. lat. 75-86.

Caranx Georgianus, *Cuv.* and *Val.* (A.) Silver Trevally. D. 8 : 1·26-29. A. 2 : 1·22-24. L. lat. 20-25.

Seriola Lalandii, *Cuv.* and *Val.* (A.) Port Jackson Kingfish. D. 7 : 1·32-34. A. 2 : 1·20-21.

Seriola grandis, *Cast.* A. Tasmanian Yellow Tail. D. 6 : 1·32-35. A. 0 : 1·20. P. 21. V. 5.

Neptonemus brama, *Gunth.* (T.) Snotgall Trevally. D. 7 : 2·27-29. A. 2 : 1·22-23. L. lat. 88.

Neptonemus dobula, *Gunth.* (T.) Mackerel Trevally. D. 7 : 1·37-40. A. 2 : 1·23.

Neptonemus travale? *Cast.* (A.) Port Jackson Snotgall. D. 6 : 2 : 30. A. 2 : 2·21. L. lat. 93.

Temnodon saltator. *Bl.* Skipjack. D. 8 : 1·24-26. A. 1-2 : 1·26-28. L. lat. 90-100.

Fam. CYTTIDÆ. (2.)

Cyttus Australis, *Rich.* (A.Z.) Bastard Dory. B. 8. D. 8-9 : 1·28-29. A. 2·30. P. 11. V. 1·6.

Zeus Australis, *Rich.* (A.Z.) John Dory. D. 10 : 23. A. 4·22. V. 1·6.

Fam. SCOMBRIDÆ. (6.)

Gasterochisma melampus, *Rich.* (Z.) Butterfly Fish. B. 7. D. 17 : 1·10 : VI. V. 1·5. A. 2·10 : VI. P. 21. L. lat. 64. L. tr. 27.

Scomber Australasicus, *Cuv.* and *Val.* Australian Mackerel. D. 10 : 1·11 : V. A. 1 : 1·11 : V. L. lat. 160.

Thynnus thynnus, *L.* The Tunny. D. 14 : 1·13 : IX. A. 2·12 : VIII.

Auxis Rochei, *Risso.* A. D. 10-11 : 12. VIII : A. 12-14. VII.

Naucrates ductor, *L.* Pilot Fish. D. 3-6 : 1·26-28. A. 2·16-17.

Echeneis remora, *L.* Sucking Fish. D. 16-18 : 22-24. A. 25.

Fam. TRACHINIDÆ. (6.)

Kathetostoma læve, *Bl.* (A.Z.) Cat Fish. D. 17. A. 17. V. 1-5.

Percis Allporti, *Gunth.* (T.) D. 5 : 21. A. 16. L. lat. 62. L. tr. $3\frac{1}{2}$: 15.

Uphritis Urvillii, *Cuv* and *Val.* (T.) Sandy. D. 6 : 19. A. 25. L. lat. 65.

Sillago ciliata, *Cuv.* and *Val.* (A.) Whiting. D. 11 : 1·17-18. A. 2·18-19. P. 14-15. L. lat. 70. L. tr. 4-5 : 11-12.

Sillago maculata? *Quoy* and *Gaim.* (A.) Spotted Whiting. D. 11 : 1·20. A. 1·21. L. lat. 70. L. tr. 5-6 : 7.

Bovichthy's variegatus, *Rich.* D. 8 : 18. A. 13.

Fam. PEDICULATI. (2.)

Brachionichthys hirsutus, *Lacep.* (A.) Handfish. D. 1 : 2 : 16-19. A. 9. P. 7. V. 1·4.

Brachionichthys politus, *Rich.* (A.) Red Handfish. D. 1 : 2 : 17. A. 9. V. 1·4.

Fam. COTTIDÆ. (5.)

Platycephalus Bassensis, *Cuv.* and *Val.* (A.) Common Flathead. D. 1 : 7 : 14. A. 14. L. lat. 115.

Platycephalus cinereus, *Gunth.* (A.) Black Flathead. D.1 : 7 : 12. A. 17. L. lat. 70.

Lepidotrigla vanessa, *Rich.* (A.) Butterfly Gurnard. D. 11 : 17. A. 17. L. lat. 70.

Trigla polyommata, *Rich.* (A.) Flying Gurnard. D. 7-9 : 12-13. A. 12.

Trigla kumu, *Less.* and *Gaim.* (A.Z.) Kumu Gurnard. D. 9-10 : 16-17. A. 15.

Fam. GOBIIDÆ. (2.)

Gobius Tamarensis, *Johnston.* (T.) Goby. B. 4. D. 6 : 1-8. A. 1·8. L. lat. 32. P. 16-18. C. 18-19.

Callionymus lateralis. *Macleay.* (A.) D. 4 : 8. A. 8.

Fam. BLENNIIDÆ. (8.)

Blennius Tasmanianus, *Rich.* (T.) Blenny or Bully. B. 6. D. 12 : 17-18. A. 2·19. P. 14.

Salarias meleagris, *Cuv.* and *Val.* (A.) Blenny. D. 12 : 20. A. 22.

Clinus despicillatus, *Rich.* (A.) Blenny. D. 3·35·4. A. 2·25. V. 1·3.

Clinus Johnstoni, *S. Kent.* (T.) Johnston's Blenny. D. 2-3 : 32-33 : 5. A. 2·25-26. V. 1·3.

Cristiceps Australis, *Cuv.* and *Val.* (A.) Blenny. D. 3·27-29·5-8. A. 2·23-25. V. 1·3.

Cristiceps Forsteri, *Cast.* (A.) Blenny. D. 3·29·4. A. 26. V. 1·3.

Tripterygium Clarkei. *Morton.* T. Blenny.

Patæcus armatus, *Gunth.* (A.) Patæcus. D. 32. A. 11. P. 8.

Fam. SPHYRÆNIDÆ. (2.)

Sphyræna Nova-Hollandiæ, *Gunth.* (A.) D. 5 : 1·9. A. 1·10. L. lat. 135.
Lanioperca mordax, *Gunth.* (A.) Tasmanian Jack. D. 5 : 1·19. A. 2·25-29. P. 16. L. lat. 61.

Fam. ATHERINIDÆ. (6.)

Athernia presbyteroides, *Rich.* Silver Belly, Sand-smelt. D. 9 : 10-11. A. 1·12. P. 11.
Atherina hepsetoides, *Rich.* Silver Belly. D. 9 : 1·11. A. 1·14. P. 15.
Atherina hepsetus, *L.* Silver Belly.
Atherina microstoma, *Gunth.* Silver Belly. D. 6 : 1·10. A. 1·12. P. 12. L. lat. 40. L. tr. 8.
Atherina Tamarensis, *Johnston.* (T.) Silver Belly. 8 : 1 : 11. A. 1·10-11. P. 13. L. lat. 42. L. tr. 9.
Atherenichthys Jacksoniana, *Quoy* and *Gaim.* D. 8 : 1·11. A. 1·18.

Fam. MUGILIDÆ. (2.)

Mugil cephalotus, *Cuv.* and *Val.* (A.) Sand Mullet. D. 4 : 1·8. A. 3·7-8. L. lat. 38-40. L. tr. 14-15.
Agonostoma Forsteri, *Bl.* Sea Mullet, Estuary Mullet. D. 4 : 1·10. A. 3·12. L. lat. 55.

Fam. CENTRISCIDÆ. (1.)

Centriscus scolopax, *L.* (A.) Snipe, Bugler, or Trumpet Fish. B. 4. D. 5 : 12. A. 20. P. 16.

Fam. GOBIESOCIDÆ. (2.)

Crepidogaster Tasmaniensis, *Gunth.* (A.) B. 5. D. 10. A. 9.
Gobiesox cardinalis, *Ramsay.* (T.)

Fam. LOPHOTIDÆ. (1.)

Lophotes Guntheri, *Johnston.* (T.) Lophotes.

Fam. TRACHYPTERIDÆ. (2.)

Regalecus gladius. *Cuv.* and *Val.* Ribbon Fish. B. 6. D. 342. A. 0. C. 0. P. 14. V. 1.
Trachypterus altivelis, *Kner.* Paper Fish. B. 6. D. 7 : 190. A. 0. C. 6 : 4-6. P. 11. V. 7.

Fam. POMACENTRIDÆ. (1.)

Glyphidodon Victoriæ. Rock Perch. D. 13 : 17. A. 2 : 15. L. lat. 30. L. tr. 4 : 10.

Fam. LABRIDÆ. (13.)

Cossyphus cerulæus, *Ogilby.* (A.) Blue Head.

Cossyphus unimaculatus, *Gunth.* (A.) D. 12 : 11. A. 3·12. L. lat. 36. L. tr. 6·12.

Labrichthys bothryocosmus, *Rich.* (A.) Parrot Fish. D. 9 : 11 : A. 3·10. L. lat. 27. L. tr. 3 : 9.

Labrichthys Mortoni, *Johnston.* Golden Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 23.

Labrichthys fucicola, *Rich.* Purple Parrot Fish. B. 6. D. 9 : 11. A. 3·10. L. lat. 27. P. 13.

Labrichthys psittacula, *Rich.* Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 27. L. tr. 3·9.

Labrichthys laticlavius, *Rich.* Blue-streak Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 26. L. tr. 3·9.

Labrichthys tetrica, *Rich.* Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 27. L. tr. 3·9

Labrichthys Cuvieri, *Cast.* Parrot Fish. D. 9 : 11. A. 3·10. L. lat. 27.

Odax balteatus, *Cuv.* and *Val.* Ground Mullet. D. 15-17 : 12-13. A. 3·12-13. L. lat. 39.

Odax Richardsoni, *Gunth.* Stranger. D. 17 : 13-14. A. 3·10-12. L. lat. 60. L. tr. 7 : 20.

Odax Beddomei, *Johnston.* Beddome's Odax. D. 20 : 12. A. 3·9. L. lat. 40. L. tr. 3·8-9.

Olistherops Brownii, *Johnston.* Brown's Olistherops. D. 10 : 18. A. 3·9. L. lat. 58-60. L. tr. 7·14.

Fam. GADOPSIDÆ. (1.)

Gadopsis marmoratus, *Rich.* Freshwater Blackfish. B. 6. D. 10-13 : 25-26. A. 3 : 18-19. V. 1.

Fam. GADIDÆ. (2.)

Lotella Swanii. *Johnston.* Kelp Cod. B. 7. D. 4 : 60. A. 55. V. 8. P. 22-23. L. lat. 200.

Pseudophycis barbatus, *Gunth.* Rock Cod. D. 9-11 : 48-57. A. 44-57. V. 5. L. lat. 100-140.

Fam. OPHIDIIDÆ. (2.)

Genypterus Australis, *Cast.* Ling. B. 7. D. 159. A. 123-126. P. 19. L. lat. 261-307.

Fierasfer Homei, *Rich.* Home's Ling. B. 7. Fins very low. Continuous.

Fam. MACRURIDÆ. (2.)

Macrurus Australis, *Rich.* (A.) D. 13·88. A. 87. V. 7. L. lat. 130. L. tr. 4 : 15.

Coryphænoides Tasmaniæ, *Johnston.* (T.) Tasmanian Whip-tail. B. 7. D. 15 : 103. A. 90. V. 8.

Fam. PLEURONECTIDÆ. (4.)

Amnotretis rostratus, *Gunth.* (T.) Sole. B 7. D. 79-81. V. dext. 6-7.; sin. 4. L. lat. 89-90.
Rhombsolea monopus, *Gunth.* (A.) Flounder. B. 5. D. 59-60. V. 6. A. 42-43.
Rhombsolea tapirina, *Gunth.* (A.) Flounder. B. 6-7. D. 64-66. A. 46-50.
Solea liturata ? *Rich.* (T.) Richardson's Sole.

Fam. HAPLOCHITONIDÆ. (2.)

Prototroctes maræna, *Gunth.* (A.) Freshwater Herring or Cucumber Fish. B. 6. D. 10. A. 19. O. 13. L. lat. 78. L. tr. 19.
Haplochiton Sealii, *Johnston.* (A.) Derwent Smelt. B. 6. D. 8-9. A. 19-20. P. 9-12.

Fam. SCOPELIDÆ. (1.)

Alepidosaurus ferox, *Lowe.* (T.) B. 6-7. D. 41-44. A. 14-17. P. 14-15. V. 9-10.

Fam. SALMONIDÆ. (5.)

Retropinna Richardsoni, *Gill.* (A.Z.) Whitebait. B. 6. D. 11-12 : A. 17-20. P. 11. V. 6. L. lat. 61.
Salmo salar, *L.* (I.) Salmon. B. 11-12. D. 14. A. 11. P. 14. V. 9. L. lat. 120. L. tr. 22-26 : 19-22.
Salmo trutta, *Flem.* (I.) Salmon Trout. B. 11. D. 13. A. 11. P. 15. V. 9. L. 6-120. L. tr. 24-26 : 36-34.
Salmo fontinalis, *Milch.* (I.) Golden Trout.
Salmo fario, *var. Ausonii.* (I.) Brown Trout. D. 13-14. A. 10-11. P. 13. V. 9. L. lat. 120. L. tr. 26-30 : L. tr. 26 : 30.

Fam. GALAXIDÆ. (5.)

Galaxias truttaceus, *Cuv.* and *Val.* (T.) Spotted Trout. B. 9. D. 11. A. 14-15. V. 7. P. 14.
Galaxias auratus, *Johnston.* (D.) Golden Lake Trout. B. 9 D. 11-12. A. 14. V. 17. P. 16.
Galaxias attenuatus, *Jenyns.* (A.Z.) Jolly Tail. D. 12. A. 16. V. 7.
Galaxias Weedoni, *Johnston.* (T.) Mersey Jolly Tail. D. 11. A. 14. P 15.
Galaxias Atkinsoni, *Johnston.* (T.) Pieman Jolly Tail. B. 9. D. 11. P. 13. A. 14. V. 8.

Fam. SCOMBRESOCIDÆ. (1.)

Hemirhamphus intermedius, *Cant.* (A.Z.) Gar Fish. D. 15-17 A. 18-20. P. 11.

Fam. CYPRINIDÆ. (3.)

Carassius vulgaris, *Nilsson.* (I.) European Carp.
Carrassius auratus, *L.* (I.) Gold Fish.
Tinca vulgaris, *Cuv.* (I.) English Tench.

Fam. Gonorhynchidæ. (1.)

Gonorhynchus Greyi, *Rich.* (A.Z.) Sand Eel. B. 4. D. 11-13. A. 9. V. 9.

Fam. Clupeidæ. (3.)

Engraulis enchrasicholus *(var. antipodum)*, *L.* The Anchovy. B. 12-13. D. 16-17. A. 18-20. L. lat. 48-50.

Clupea sprattus, *L.* The Sprat. B. 6-7. D. 15-18. A. 17-20. V. 7. L. lat. 47-48.

Clupea sagax, *Jenyns.* Pilchard. B. 7. D. 18. A. 18-19. L. lat. 50-54.

Fam. Symbranchidæ. (2.)

Chilobranchus dorsalis, *Rich.* (A.) Small Shore Eel.

Chilobranchus rufus, *Macleay.* (A.) Red-banded Shore Eel.

Fam. Murænidæ. (5.)

Anguilla Australis, *Rich.* (A.) Common Eel.

Conger vulgaris, *Cuv.* (A.) Conger Eel.

Conger Wilsoni, *Cast.* (A.Z.) Conger Eel.

Murænichthys breviceps, *Gunth.* (A.)

Congromuræna habenata, *Rich.* (A.Z.) Silver Eel.

Fam. Pegasidæ. (1.)

Pegasus lancifer, *Kaup.* (A.) Pegasus. D. 5. A. 5. P. 15. V. 2.

Fam. Syngnathidæ. (9.)

Syngnathus, semifasciatus, *Gunth.* (A.) Pipe Fish. D. 38. O. R. 21+49.

Syngnathus curtirostris, *Cast.* (A.) Pipe Fish. D. 20-22. O. R. 18+42.

Stigmatophora argus, *Rich.* (A.) Pipe Fish. D. 49-52. O. R. 20+75.

Stigmatophora nigra, *Kaup.* (A.) Pipe Fish. D. 39-40. O. R. 17+42.

Stigmatophora gracilis, *Macleay.* (T.) Pipe Fish. D. 58. O. R. 30+56.

Solenognathus spinosissimus, *Gunth.* (A.) Pipe Fish. D. 35. O. R. 27+56.

Phyllopteryx foliatus, *Shaw.* (A.) Leaf-winged Sea Horse. D. 30. O. R. 18+35.

Hippocampus abdominalis, *Kaup.* (T.) Sea Horse. D. 28-31.

Hippocampus breviceps, *Peters.* (A.) Yellow-ringed Sea Horse. D. 19-21.

Fam. Sclerodermi. (12.)

Monocanthus Gunnii, *Gunth.* Dark Brown Leather Jacket D. 34. A. 33.

Monocanthus convexirostris, *Gunth.* Grey Leather Jacket. D. 34-37. A. 32-35.

Monocanthus Peronii, *Holland.* Pale Brown Leather Jacket. D. 33-35. A. 33.

Monocanthus Guntheri, *Macleay.* Tooth-brush Leather Jacket.

Monocanthus spilomelanurus, *Quoy* and *Gaim.* Golden Streak-eyed Leather Jacket. D. 30-32. A. 28-32.

Monocanthus maculosus. *Rich.* Small Brown Leather Jacket. D. 29-33. A. 29-30. P. 12.

Monocanthus Baudini, *Cast.* Lozenge-scaled Leather Jacket. D. 35. A. 31. P. 13.

Monocanthus melas, *Gunth.* Black Leather Jacket. D. 34. A. 34.

Monocanthus rudis, *Rich.* White-banded Leather Jacket. D. 34-35. A. A. 34.

Monocanthus hippocrepis, *Quoy* and *Gaim.* Blue-banded Leather Jacket. D. 35-37. A. 33-36.

Ostracion auritus, *Shaw.* Trunk Fish. Head spine deflected.

Ostracion ornatus, *Gray.* Trunk Fish. Head spine erect, pointing out.

Fam. Gymnodontes. (5.)

Tetrodon Hamiltoni. *Rich.* Toad Fish.

Tetrodon Richei, *Frem.* Globe Fish.

Chilomycterus jaculiferus, *Cuv.* A. Porcupine Fish.

Atopomycterus nychthemerus, *Cuv.* Slender spined Porcupine Fish.

Orthagoriscus mola. *L.* Sun Fish. D. 17-18. A. 14-17. C. 12-16. P. 12-13.

Sub-Class. CHONDROPTERYGII.

Fam. Chimæridæ. (1.)

Callorhynchus antarcticus, *Lacep.* Elephant Fish.

Fam. Carcharidæ. (4.)

(Eye with a nictitating membrane. 1 anal and 2 dorsal fins.)

Carcharius glaucus, *L.* (E.) Blue shark.

Galeus canis, *Rondel.* (E.) The Tope. School Shark.

Zygæna malleus, *Shaw.* Hammer-head.

Mustelus antarcticus, *Gunth.* Smooth Hound. Gummy.

Fam. Lamnidæ. (3.)

(No nictitating membrane. 1 anal and 2 dorsal fins.)

Lamna cornubica, *Flem.* Porbeagle.

Odontaspis Americanus, *Mitch.* Grey Nurse.

Alopecias vulpes, *L.* Thrasher.

Fam. Notidanidæ. (1.)

(1 dorsal only. 1 anal.)

Notidanus indicus, *Cuv.* Tasmanian Blue Shark

Fam. SCYLLIDÆ. (4.)

(No nictitating membrane. 2 dorsal and 1 anal fin).

Scyllium maculatum. *Bl.*
Scyllium laticeps, *Dum.*
Parascyllium variolatum, *Dum.*
Crossorhinus barbatus, *L.* Wobbigong.

Fam. CESTRACIONIDÆ. (1.)

(No nictitating membrane. 2 dorsal and 1 anal fin.)

Heterodontus Phillipii, *Lacep.* Port Jackson, or Bull-head Shark.

Fam. SPINACIDÆ. (2.)

(No nictitating membrane. No anal fin.)

Acanthias vulgaris, *Risso.* A. Spotted Spiny Dog.
Acanthias Blainvillii, *Risso.* A. Spiny Dog.

Fam. RHINIDÆ. (1.)

(No anal fin. Pectoral fins large.)

Rhina squatina, *L.* Angel Shark.

Fam. PRISTIOPHORIDÆ. (2.)

(Snout much produced, saw-like.)

Pristiophorus cirratus, *Latham.* (A.) Sawfish. Sets teeth upper jaw, 42.
Pristiophorus nudipinnis, *Gunth.* (A.) Sawfish. Sets teeth upper jaw, 35-39.

RAYS.

Fam. RHINOBATIDÆ. (1.)

Trygonorhina fasciata, *Mull and Henle.* The Fiddler.

Fam. TORPEDINIDÆ. (1.)

Narcine Tasmaniensis, *Rich.* Electric Torpedo. Disc elliptical.

Fam. RAJIDÆ. (1.)

Raja Lemprieri, *Rich.* Thorn-back Skate.

Fam. TRYGONIDÆ. (1.)

Urolophus cruciatus, *Lacep.* Stingaree.

Fam. MYLIOBATIDÆ. (1.)

Myliobatis aquila. *L.* Eagle or Whip-tail Ray.

SUB-CLASS. CYCLOSTOMATA.

Fam. PETROMYZONTIDÆ. (2.)

Mordacia mordax, *Rich.* (A.) Common Lamprey.
Geotria Allporti, *Gunth.* (T.) Pouched Lamprey.

SUB-CLASS LEPTOCARDII.

Fam. CIRROSTOMI. (1.)

Branchiostoma lanceolatum, *Pall.* The Lancelet.

FISHING INDUSTRY.

With a scattered and insulated population of about 150,000 inhabitants, it cannot be expected that the fishing industry of Tasmania can be extensive. Nevertheless it is estimated that there are about 86 boats and 175 men engaged therein. The individuals employed hawking the fish within the two chief towns may be estimated at about 80 in number. Altogether it is estimated that, exclusive of the whaling trade, there are 1,050 persons directly depending upon the local fisheries. Hobart, the capital city, is the chief centre of the industry, its position being favourable in this respect from its proximity to the principal fishing-grounds, and its splendid harbour being accessible in all kinds of weather.

Fully 63 per cent. of the men and boats belong to Hobart, and the men carry on their vocation either in the numerous sheltered indentations or bays in the upper or lower waters of the estuary of the Derwent, or in the exposed open sea between Seymour on the north-east and Port Davey on the south-west. The fishing carried on elsewhere, with the exception of the purely river fishing of the Tamar, is very limited, generally engaged in at odd times by persons who do not devote themselves exclusively to the fishing industry. The Tamar boats are not suited for fishing in the open sea of Bass Straits.

With the exception of three or four decked smacks, the most of the boats employed in the waters of the Derwent, or in the open sea Trumpeter and Barracouta fishing-grounds, are mere open centre-board whaleboats, fitted with fish-wells perforated in direct communication with the sea, and designed to keep the fish alive until sold in the open market in the Fisherman's Dock, Hobart.* The Trumpeter and other fish will feed in such confinement, and the former has been known to live healthily in this way for a period of three months.

The average value of one of these excellent sea-boats† is about £100, and the equipment, in the shape of nets and deep sea lines, say £20; in all, say £120 for each boat. There are usually two or three men to each boat. Even with a small crew of this kind, as much as 40 dozen Kingfish, weighing 12 to 14lbs. each, have been caught in a single night when the fish have been plentiful. Barracouta can be captured in large quantities during the season—January to June. About 24 dozen Barracouta weigh a ton. The fishermen state that, could they be assured of a market, 3s. a dozen for Barracouta or Kingfish would amply repay them,—*i.e.*, about $\frac{1}{4}$d. a pound.

* Salt water.

† Generally about 37 feet 6 inches long; beam, 7 feet 8 inches; depth, about 3 feet.

The following are additional particulars regarding the average quantity of fish exported each year, which hitherto have been despatched almost wholly to Victoria:—

	Doz.	Weight.	Average Price.
		lbs.	
Trumpeter *(Latris hecateia)*...	66	3 to 60	1s. per lb.
Perch *(Chilodactylus macropterus)*	123	2 to 7	6s. to 7s. per doz.
Trevally *(Neptonemus brama)*...	52	1 to 14	8s. to 12s. per doz.
Barracouta *(Thyrsites atun)*.....	1132	9 to 10	3s. per doz.
Kingfish *(Thrysites Solandri)*...	1056	12 to 14	3s. per doz.
Conger Eel *(Conger vulgaris)*...	44	7 to 50	½d. per lb.
Crayfish *(Palinurus Edwardsii)*	923	avg. 4	5s. per score.
Total per year.....	3396		

It is very difficult to estimate the value of fish sales, as no systematic register has been kept for the whole colony. It is probable, since the decline of the Oyster fishery, that the yearly sales do not exceed £10,000 per annum.

The value of boats and equipment at present engaged in the fishing industry of Tasmania may be roughly estimated at about £7,700. This does not embrace the ships employed in the Whale fisheries. The latter industry has declined considerably during the last decade, as shown by the following summary:—

	Average per year, First Quinquennium.	Average per year, Second Quinquennium.
Ships	16	11
Tonnage	4,164	3,055
Men	390	312
Value of Oil.....	£31,281	£19,223

The reason of this falling off is stated to be chiefly owing to the decline in price arising from the introduction of minerals oils. Excessive fishing and consequent scarcity of oil is also referred to as a cause of decline.

Fishing Grounds.

Generally, the Fishing Grounds may be divided into three classes:—1. The Home Grounds 2. The Middle Grounds. 3. The Outer, or Open-sea Grounds.

1. *The Home Grounds*, near shore, or in the upper shallows of the estuaries of the Derwent and Tamar.—The fishing grounds at Port Sorell, Bridport, and George's Bay may be included with this division. The fish captured in these situations consist chiefly of Flounders, Mullet, Garfish, Flathead. Crayfish, Prawns, and Oysters are also taken in the Home Grounds.

2. *The Middle Grounds.*—Within this division may be included those fishing reefs and banks lying in the more exposed situations of estuaries—such as Wedge Bay and Adventure Bay, in the Derwent—in depth of water from five to six fathoms. In such localities the grab-all net and ordinary hand-lines are used in the capture of Native Salmon, Silver Bastard, Black and Silver Perch, Carp, Rock Cod, Ling, Conger Eel, etc. The indentations around the Eastern and Western Coasts afford ample scope for following out the industry within the limits of this division, especially so in the many sheltered bays in the neighbourhood of Port Davey and Macquarie Harbour.

3. *The Outer, or Open-sea Grounds.*—These principally are situate in the southern and eastern waters of Tasmania, and generally from 1 to 16 miles off the coast, upon coral banks or reefs 10 to 80 fathoms deep. The latter depth is the limit at which Tasmanian fishermen have been successful with deep sea-lines on the Trumpeter banks. Towards the surface of these open waters the Maori jig is principally used in the capture of the Barracouta, and in the season the line, armed with swivelled chain and stout barbless hook, is employed in the capture of the rapacious but valuable Kingfish.

The fishermen, as a class, are as a rule steady and industrious, and although they do not seem to have any special provision in the shape of Friendly Societies or other providential aids, distress is rare and poverty unheard of. Beyond the provisions for acclimatisation and protection of the European Salmonidæ, the establishment of Oyster beds for breeding purposes, and certain reserves for the protection of natural beds, the Government have also found it necessary to provide measures for the limitation of the sale of unwholesome or undersized fish, and for prescribing the size of mesh for *graball* and *seine nets.* No graball can be used in Tasmanian waters whose mesh is of any size, measured diagonally, between $2\frac{1}{2}$ inches and 4 inches.

The prescribed limits of undersized fish that may be taken or sold are :—

Bastard	12	inches	and	over
Real Trumpeter	13	"	"	"
Garfish	8	"	"	"
Bream	10	"	"	"
Flounders...	9	"	"	"
Crayfish	10	"	"	"

In the case of the introduced Salmonoids, and as regards the Oyster and Flounder, special provisions have been made for their preservation and development in respect of close seasons, modes of capture, and the absolute or partial closing of particular areas as nursery grounds as a means of protection. This was absolutely necessary to ensure the successful acclimatisation of the Salmonidæ first introduced from Europe in the year 1864.

The fishes successfully introduced are *Salmo salar*, *Salmo trutta*, *Salmo fario* var. *Ausonii*, *Salmo fontinalis*, *Tinca vulgaris*, *Cyprinus auratus*, *Cyprinus carassius*, *Perca fluviatilis*.

Fish Sold in Hobart Fish Market During the Year 1888.

	Quantity	Price.			Value.		
		Max.	Min.	Average	£	s.	d.
Fish.							
Barracouta .....doz.	2,410	10s.	7s.6d.	8s.	964	0	0
Bream ..... "	9	14s.	8s.	10s.	4	10	0
Carp ..... "	103	5s.	3s.	4s.	20	12	0
Eels (Conger) ..... "	70	12s.	10s.	11s.	38	10	0
Flathead ..... "	2,241	1s.	1s.	1s.	112	1	0
Flounders ..... "	1,126	6s.6d.	4s.	5s.	281	8	0
Garfish ..... "	10,229	1s.	5d.	6d.	255	14	6
Gurnet (Rock) ..... "	111	4s.	2s.9d.	3s.	16	13	0
Kingfish ..... "	¾	60s.	60s.	60s.	2	5	0
Ling ..... "	21	24s.	3s.	7s.	7	7	0
Mullet ..... "	3,202	1s.9d.	4d.	1s.	160	0	0
Mackerel (Horse) ..... "	68	2s.	4d.	1s.	3	8	0
Perch ..... "	3,629	5s.	3s.6d.	4s.	735	16	0
Ditto (Red) ..... "	3	4s.	4s.	4s.	0	12	0
Rock Cod ..... "	2,158	2s.	1s.	2s.	215	16	0
Salmon (Native) ..... "	2,358	1s.	4d.	8d.	78	12	0
Trumpeter (Real) ..... "	447	100s.	20s.	31s.7d.	737	10	0
Ditto (Red Bastard) "	3,431	5s.6d.	4s.	5s.	857	15	0
Ditto (Silver ditto).. "	46	48s.	12s.	17s.6d.	30	12	6
Trevally ..... "	75	6s.	2s.	4s.	15	0	0
Whiting ..... "	16	3s.	1s.	1s.6d.	1	4	0
	31,753				4,539	6	0
Crustaceans.							
Crayfish ..... score	3,434	5s.	4s.	5s.	858	10	0
Molluscs.							
Cockles ..... bushels	8	5s.	5s.	5s.	2	0	0
					£5,399	16	0

Salmon and Trout Breeding Establishment.

	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Ova introduced from Europe ...	...	...	80,000*	160,000*	...	...	400,000*
Ova exported to other Colonies..	24,000	17,000	2,000	7,500	13,000	12,000	6,000
Salmon Fry liberated in various Rivers, etc.....	3,950	6,600	8,650	31,229[d]	116,200	33,880	9,000
Licences issued—Receipts from Sales of Ova and Licenses...	297	266	216	253	263	269	258
Working Expenses	277[a]	319	355[b]	465[c]	341	296	437

* *Salmo salar.*

[a] Exclusive of £100 for importation of ova.

[b] Exclusive of £460 for importation of Ova from England.

[c] Includes £170, special repairs to troughing.

[d] Includes 28,128 fry of *S. salar*, *ex* ova per *Yeoman*, from Ireland, hatched at the Plenty.

General Fisheries Department.

	1882.	1883.	1884.	1885.	1886.	1887.	1888.
Receipts.....	...	...	...	...	...	...	...
Working Expenses ..	...	...	...	935	...	1,369	677

Whale Fisheries.

Year.	Vessels employed.		Tonnage.	Value of Fisheries.	Remarks.		
	Ships.	Boats.					
				£			
1828	3	23	...	11,268	In 1822, 724 tuns oil and 3 tons whale fins were exported. In 1823 226 casks of oil and 52 pkgs. whalebone were exported.		
1829	7	26	...	12,313			
1830	10	42	...	22,065			
1831	9	55	...	33,549			
1832	12	75	...	37,176			
1833	15	105	...	30,620			
1834	23	84	...	56,450			
1835	35	155	...	64,858			
1836	14	48	1,187	57,660			
1837	18	75	2,739	135,210			
1838	19	79	1,999	98,660			
1839	26	...	3,146	65,600	Foreign.		
1840	27	...	3,224	66,850			
1841	22	...	3,170	71,600		Ships.	Tonnage.
1842	18	...	2,842	87,400			
1843	21	...	3,307	74,100			
1844	24	...	4,264	49,840		12	3,838
1845	28	...	4,460	73,300		16	5,518
1846	28	...	4,057	65,150		13	4,825
1847	27	...	4,729	70,000		21	6,890
1848	29	...	6,081	104,000		26	8,497
1849	34	...	7,791	46,117 Oil exported.		11	3,803
1850	40	...	9,724	49,547		9	2,779
1851	26	...	6,538	49,022		14	4,687
1852	18	...	3,999	36,776		18	6,300
1853	7	...	1,903	30,106		2	704
1854	6	...	1,622	27,863		2	737
1855	17	...	3,566	44,110			
1856	33	...	6,975	53,670			
1857	...	...	...	46,211			
1858	...	...	...	49,878			

Year.	Vessels.	Tonnage.	Value of Oil Exported.	No. of Men.
			£	
1859	...	...	63,500	...
1860	...	...	57,350	...
1861	...	...	60,230	...
1862	...	...	60,730	...
1863	...	...	30,175	...
1864	...	...	19,925	...
			Produce brought into Port.	
1866	9	2,257	38,000	229
1867	10	2,428	22,800	245
1868	16	3,996	52,546	395
1869	17	4,364	48,910	415
1870	15	3,446	35,880	376
1871	19	4,917	46,350	470
1872	19	4,917	27,420	488
1873	18	4,765	44,000	444
1874	16	4,088	30,780	389
1875	13	3,525	12,465	315
1876	13	3,525	41,740	315
1877	12	3,295	31,605	324
1878	11	3,156	16,920	321
1879	11	3,156	13,425	326
1880	10	2,780	12,045	296
1881	10	2,780	22,120	296
1882	8	2,357	19,096	196
1883	7	2,014	14,685	168
1884	6	1,745	11,715	151
1885	7	2,014	12,600	167
1886	5	1,480	6,150	124
1887	4	1,151	10,450	99
1888	3	783	6,165	70

DO THE CHANGES OF THE MOON AFFECT THE RAINFALL?

By E. C. Nowell, Hon. Member Royal Statistical Society.

The idea that the changes of the moon do affect the rainfall has widely prevailed from the earliest ages. Thus the Roman poet Virgil :—

" And that by sure prognostics we may know
Both heat and rain and cold-compelling winds,
The Sire himself has fixed the monthly course
Of lunar indications; by what sign
To read the sinking south ; what, oft observed,
Should teach the farmer to retain his herds
Within the sheltered precincts of the stall."

Georg I., 351 seqq., Dear's trans.

" Nor less are showerless suns and open sky
Serene by certain signs fore-known ; for then
Nor dimly seem the blunted stars to shine,
Nor rises Luna to her brother's beams
Indebted : then nor through the vault of heaven
Sail fleecy clouds ; nor to the genial beam
Do Thetis' halcyons spread their azure wings.

* * * *

When the moon,
Collecting first her renovated fires,
A gloomy mist within her horns includes,—
Then on the husbandman and on the deep
Impends a heavy rain ; but, if she rise
Her face suffused with virgin blushes, wind
Awaits ; the wind on golden Phœbe's cheek
Ever excites a blush ; but should she take
At her fourth rising (mark the surest sign)
Her course through heaven's ætherial way with clear
Unclouded aspect, nor with horns obtuse,
Then that whole day and those from thence derived,
E'en to the finished month, shall roll exempt
From wind or rain; and, on the shore secure,
The storm-scaped mariner shall pay his vows
To Glaucus, Panope, and Ino's son."

Ib., 393 seqq.

Ages before, the Babylonian Government astronomers in their reports, which they furnished daily, have such entries as these respecting the supposed influence of the heavenly bodies on the weather :—

" The star of the upper sphere aforesaid causes fog and rain."

" The star Lulu portends extended mists."

" The star of the Wolf portends tempest."

" The stars at sunrise are for windy rain and flood."

Sailors especially are great believers in the influence of the moon on the weather.

I believe it will be found that, where ideas have become deeply rooted and widely spread, it is very seldom, if ever, that they have not some foundation in fact, though the fact may have been distorted, and the truth more or less obscured.

We have been assured, however, by some whose names carry great weight, and whose statements on such matters we should not venture to question, except on the clearest evidence, that the popular notion is a mere delusion, and that the moon's changes have no influence on the weather.

Dr. R. J. Mann, vice-president of the Meteorological Society, in an article on "High Clouds and Moonshine," in "Science for All," part 52, says:—"Amongst the long prevalent notions that have been held concerning the changes of the weather, there are, perhaps, none that have been more generally entertained and cherished than those which connect them with what are termed the changes, or, in other words, recurring phases of illumination of the moon. These notions, in all probability, were in the first instance derived from the accidental coincidence of certain marked conditions of weather with particular aspects of the moon, and from the natural tendency which exists in the minds of superficially instructed people to ascribe to the heavenly bodies a power over human events. A very few words of comment will, nevertheless, suffice to expose the fallacy of this illusion. The proposition, however, to which these remarks are addressed is, it must be remarked, not simply and in a general sense that the moon affects the weather experienced upon the earth, but that the mere aspects of the moon's varying illumination exert an especial influence upon the weather of each particular locality and spot.

"The utter irrationality and absurdity of this idea becomes apparent at a glance the instant it is connected with the obvious fact that the earth is a rotating and not a fixed globe. Assuming, for the mere purpose of illustration, that it were true the new moon, the half moon, and the full moon produced some especial state, whether of storm or of calm, whether of rain or of dryness upon some given spot on the earth, as this passes round in front of the sun-illumined orb, it is manifest the same influence must continue to be exerted entirely round the earth during the subsequent twenty-five hours in which the terrestrial sphere whirls completely round before the moon;" and so on. Further on, he says:—"If the phases of the moon affected the weather, it is obvious that the same weather would prevail wherever analogous relations to the moon obtained.

"The moon, as a matter of fact, does produce a physical

influence upon the earth, but it is an influence of an altogether different kind to the one which is implied by this popular piece of weather delusion; it is the influence which is so grandly expressed in the diurnal roll of the tides of the sea, and which is due to the inter-action of the lunar and terrestrial mass." In regard to the tides the same writer tells us: "It is the moon which is operative in bringing about the result, and not the 'phases' or appearance of the moon."

But, we may ask, is not the distinction here drawn between the moon herself and her "phases" rather one of words than of things? If the moon's changes of position, which we call her "phases," cause corresponding changes in the weather, there certainly would be good reason for associating such changes with the phases under which they occur, whether the popular mode of stating the fact were strictly correct or not.

Dr. Mann goes on to say: "Now, there can be no question that the moon does produce a somewhat similar effect upon the atmosphere to that which it exerts upon the sea. As it goes round the earth, and as the earth whirls upon its axis in front of the attendant orb, a tidal swell is called up in that part of the atmosphere which is most immediately opposite and nearest to the lunar mass;* and this tidal wave in the air undoubtedly is accompanied by some change of physical state which would involve alteration of pressure, and which would be to that extent indicated by the barometer, and would tend to produce movement in the air or wind, and such weather change as is attendant upon wind. But all this, it will be observed, has nothing whatever to do with the phases or changes of the moon. The effect, whatever it may be, is precisely the same whether the moon is new, or half illuminated, or full. It is determined and measured only by the revolution, distance, and mass of the moon, and by the dimensions and rotation of the earth." But the inference is drawn from certain observed facts "that the heat reflected from the full moon does exert a palpable effect upon the atmosphere, although it does not penetrate to the solid surface of the earth;" and Sir John Herschel is said to have noticed "how very commonly the nights of the full moon at the Cape of Good Hope were absolutely cloudless and clear;" and this observation, we are informed, is confirmed by the experience of nearly nine years of the author of the article from which I have quoted in the neighbourhood of Natal.

Dr. Lardner, in his "Weather Prognostics" (Museum of Science and Art, vol. I. p. 80), after reviewing the investigations of different persons on the subject of the moon's

* One cannot help noticing the remarkable coincidence between the words of the ancient poet already quoted, *fratris radiis obnoxia Luna*, and those of the exponent of modern science.

influence on the weather, observes: "Those who are impressed with the feeling that an opinion so universally entertained, even in countries remote from each other, as that which presumes an influence of the moon over the weather, must have some foundation, will do well to remember that against that opinion we have not here opposed mere theory. Nay, we have abandoned for the occasion the support that science might afford, and the light it might shed on the negative of this question, and have dealt with it as a mere question of fact. It matters little, so far as this question is concerned, in what manner the moon and sun may produce an effect on the weather, nor even whether they be active causes in producing such effects at all. The point, and the only point of importance is, whether regarded as a mere *matter of fact*, any such correspondence between the changes of the moon and those of the weather exist, as is popularly supposed? And a short examination of the recorded facts proves that IT DOES NOT." And Dr. Ball, Royal Astronomer of Ireland, in his "Story of the Heavens," published in 1886, p. 59, says: "There is one widely credited myth about the moon which must be regarded as devoid of real foundation. The idea that the moon and the weather are connected has no doubt been entertained by high authority, but careful comparison has shown that there is no definite connection between the two." I venture to think that the results which I shall bring before the members of this Society will show that these opinions are premature, and will have to be modified, and that, after all, the popular persuasion is not without some foundation in fact.

Seeing that the statements of scientific men and the popular notions on the subject of the moon's influence on the weather seemed to be at variance, I resolved to investigate the matter for myself; and accordingly in 1880 I began to keep a meteorological journal in a rough way, and have continued it up to the present time. There is only one hiatus of about a fortnight, caused by my absence from home. Having now ten years' observations to work upon, I thought I might safely proceed to ascertain what conclusions might be drawn from them, and with that view prepared table B appended to this paper.

It should be mentioned that every fall of rain, however slight, unless unintentionally omitted, is recorded; and that rain is noticed in the tables only on the first day on which it occurs in connection with any particular change. When, therefore two or more rain-days come together, only the first is tabulated, the others being omitted: but when a break of a whole day occurs, any subsequent fall of rain is treated as distinct, and tabulated accordingly.

I have thought it better not to go beyond the seventh day, since it is only occasionally that the interval between one change of the moon and another extends beyond that day.

By way of testing the accuracy of my own observations, I constructed another table (A) on the same principles, from the data furnished by the late Mr. F. Abbott, and published in the papers of this Society, taking in the previous ten years, from 1870 to 1879 inclusively. If the two tables be thrown into one, they will embrace a period of twenty years, from 1870 to 1889. In Mr. Abbott's tables, as printed, I found two gaps, one of a month, and another of a fortnight, but was fortunately able to supply the omissions from the meteorological journal kept by Mr. W. E. Shoobridge, which he was kind enough to leave in my hands.

My observations, as thus tabulated, give the following results for the ten years from 1880 to 1889.

Taking first the totals opposite to each day, without reference to the nature of the moon's changes, we find that the number of times on which rain commenced in the decennium as a whole was as follows :—

On the day of the change			...	...	114
,,	second day	,,	...	...	103
,,	third	,, ,,	...	...	98
,,	fourth	,, ,,	...	...	92
,,	fifth	,, ,,	...	...	88
,,	sixth	,, ,,	...	...	73
,,	seventh	,, ,,	...	...	82

It will be seen that the number on the day of change is considerably in excess of the number on any of the other days, being at the rate of 18 per cent. nearly of the whole number (650) on the seven days, while the next highest is only about 16 per cent.

The corresponding numbers for the period 1870-79 were :—

On the day of the change			...	...	135
,,	second day	,,	...	...	80
,,	third	,, ,,	...	...	97
,,	fourth	,, ,,	...	...	81
,,	fifth	,, ,,	...	...	93
,,	sixth	,, ,,	...	...	83
,,	seventh	,, ,,	...	...	84

Here again we find the largest number on the day of the change. But in regard to the other days, the two periods vary. In the first decennium (1870-79) the next largest was on the third day; in the second decennium (1880-89), on the second.

The proportion which the numbers on the day of change bore to the total (653) on all the seven days in the first period was nearly 21 per cent.

In the second decennium (1880-89) it was found that the next largest figure was that opposite to the second day; while, in the first decennium, the next largest was in connection with the third day. Taking the two periods together the relative frequency of rain in the twenty years would be as follows:—

First day of change	...	...	...	...	249	
Second day	,,	...	...	...	..	183	
Third	,,	,,	...	...	...	...	195	
							— 627
Fourth	,,	,,	...	...	...	...	173	
Fifth	,,	,,	...	...	...	...	181	
Sixth	,,	,,	...	...	..	...	156	
Seventh	,,	,,	...	...	...	...	166	
							— 676
							1,303

Thus, it appears that 48 per cent. of the rainfalls, as here noted, occurred on the first three days of the moon's changes, being only 2 per cent. less than in the remaining four days. It will be observed that the numbers are appreciably smaller on the sixth and seventh days.

Taking now the totals under each of the moon's quarters, in the two periods, we get the following results:—

1880-89.

Total number of initial rainfalls in the whole period in	Last quarter,	159
	New moon,	165
	First quarter,	167
	Full moon,	162

1870-79.

Total number of initial rainfalls in the whole period in	Last Quarter,	177
	New Moon,	146
	First Quarter,	177
	Full Moon,	150

So far as these periods, taken separately, go, we cannot discover any law of relation between the changes, or quarters, of the moon, and the rain-fall; but when we combine the totals of the two tables and take the whole period of twenty years, the result is similar to that which we get from the latter of the two decennial periods (1870-79), the numbers for the twenty years being:

Last Quarter	...	336
New Moon	...	311
First Quarter	...	344
Full Moon	...	312

The difference between the two pairs, the first and last quarters on the one hand, and the new and full moon on the other, are so marked, as at once to suggest the idea that it is not altogether due to chance. If this be so, then there is a greater probability of rain occurring at the first and last quarters than at the new and full moon.

In my enquiries I have not given any attention to the question how far, if at all, the rain-fall is affected by the moon's apogee or perigee. But it is only reasonable to suppose that, if the greater or less proximity of the moon to the earth affects the tides, it must also cause some corresponding modification in those conditions of the atmosphere which regulate the suspension and condensation of moisture in the upper regions.

Lardner, in the work above cited, tells us that Toaldo, from a comparison of 45 years' observations at Padua, found that in every six passages of the moon through perigee there were five changes of weather, and in every five through apogee there were four changes of weather (p. 72); and that Professor Pilgrim, from a 25 years' series of observations at Vienna, arrived at the result that the influence of perigee is greater than that of any of the phases, while the influence of apogee is equal to that of the quarters and full moon, and greater than that of the new moon (p. 73). But Lardner considers that the mode in which these conclusions were reached was such as to throw some doubt upon the results. He seems to attach more weight to the investigations of M. Schübler, who, from observations taken at Munich, Stuttgard, and Augsburg, for 28 years, found that during the seven days nearest to perigee it rained 1,169 times, and during the seven days nearest to apogee, only 1,096 times. "Thus," remarks Lardner, *cæteris paribus*, the nearer is the moon to the earth the greater would be the chances for rain" (p. 75).

Further on he says: "From all that has been stated it can scarcely be denied that there exists some correspondence between the prevalence of rain and the phases of the moon. What that exact correspondence is, remains for more extended and accurate observations to inform us; but meanwhile it may be safely affirmed that it is not such as to constitute a prognostic in any sense approaching to that in which it has been popularly adopted." *(Ib.)*

With this I entirely agree; and, so far as the foregoing enquiries enable us to pronounce an opinion on the subject, the only thing which we can with any safety assert with regard to this subject, is, that there is a greater probability of having rain on the first than on any succeeding day of any of the moon's changes.

The enquiry, the results of which I have thus attempted to put before the members of this Society, will, I hope, be found to be of some value, however slight, as a contribution towards the investigation of an obscure but highly interesting subject.

Perhaps these remarks may induce others, more competent, to pursue the enquiry in a more scientific manner, and more exhaustively, than I have been able to do.

It will, of course, be understood that the inferences deduced from the appended tables are intended to apply only to the place where the observations were made, namely—Hobart and its vicinity. We may expect to get different results from similar observations at other places, and it remains to be seen whether the same laws hold good elsewhere under different conditions, or whether they are so far modified by local circumstances that each place, or group of places, has a law of its own.

In a work which I was reading a short time since, I came upon this passage:—"It is a scientific fact that virtue and vice are resultant upon the changes of weather. The police of Buenos Ayres find that quarrelling and bloodshed are more frequent when the wind blows from the north, that a sort of moral derangement prevails while it continues. The scientific explanation offered is, that this arises from some malaria engendered in the marshes over which the wind passes." (W. J. Acomb, Larger Hope Lectures, 156.)

This opens up a wide field of study which has not, as far as I know, been systematically cultivated. The present age stands out prominently as one of *disinterment*. Buried cities, such as Nineveh, Babylon, Herculaneum, Pompeii, Troy, have been unearthed; lost languages and literature have been restored. If the same method of enquiry be applied to immaterial things there can be no doubt that similar results will follow. If we closely examine many of the things which in past times were devoutly believed, but which most people in these days look upon as exploded errors, we shall find that, just as gold is embedded in quartz and has to be separated from it, in these old notions there are truths which only require to be set free from the misconceptions which were associated with them to be recognised as scientific facts. Take, for instance, lunacy. The idea was that the aberration of mind so-called, was occasioned by some malign influence of the moon. Increased knowledge has shown that the causes of insanity are very various, and that the moon has little, if anything, to do with them; but if I am not mistaken, many mad people *are* peculiarly affected at certain states of the moon, and the observation of this fact may have led to the

assumption that the moon was the cause of the disease. We have seen that she does produce such an effect upon the atmosphere as to bring on rain under certain conditions. But as the organism of both men and animals is affected by changes of weather, and as such changes are, more or less, brought about by lunar action, it follows of necessity that the moon does exercise a certain amount of control over the bodies and minds of living things, though, doubtless, not in the way and to the extent formerly imagined. Many persons of sensitive temperament are powerfully affected by moonlight; and we can easily understand how much greater the impression must be when the mind is off its balance.

Take, again, astrology. Of course, none of us believes in astrology, as commonly understood—that is, we do not believe that men's future destinies can be read in the stars in the same way as the astrologers pretended; but I think there are grounds for admitting that the stars may, like the moon, only in a less degree, have an influence on human affairs. Some years ago (in 1876) it was predicted that a rare conjunction of the greater planets would cause unusual perturbations on our earth; and certainly in the last ten years there have been greater disturbances in the physical world than have ever occurred before in my time. And in the moral world there have been corresponding disorders. It is quite conceivable that these abnormal phenomena may have had their origin in some changes of the other planets in relation to the earth, altering the force of their attraction, and so, perhaps, the magnetic condition of our globe. Whatever affects our physical state produces a corresponding change in the mind and its affections, and thus many of the remarkable tendencies of our time may be the result of atmospheric or telluric influences due to some obscure changes occurring elsewhere in the universe of which we form a part. If it be true, as modern science teaches, that the whole of creation is so bound together, and so finely adjusted, that whatever takes place anywhere produces some effect on every other portion, we need not stumble at the thought that the vast masses of matter which whirl round the centre of our system may, by their changes of position, alter the condition of things on our planet, and so have an influence upon our physical, moral, social and spiritual life.

If this be so, then it will be within the province of science to extend its researches in this direction, in order to discover, if possible, what are the exact nature and limits of the influence exerted upon the earth and its inhabitants by the moon and the remoter planets—the lesser forces—as well as by the great central source of power—the sun itself.

TABLES.

Number of days on which rain began to fall in the two decennial periods, 1870-79 and 1880-89, in connection with the changes of the moon:—

A. 1870-79.

Days of and following the Moon's Changes.	Last Quarter.	New Moon.	First Quarter.	Full Moon.	Total.
1	37	37	35	26	135
2	20	19	21	20	80
3	22	24	23	28	97
4	19	18	24	20	81
5	27	25	23	18	93
6	21	22	17	23	83
7	13	20	24	27	84
—	159	165	167	162	653

B. 1880-89.

Days of and following the Moon's Changes.	Last Quarter.	New Moon.	First Quarter.	Full Moon.	Total.
1	29	24	34	27	114
2	28	27	25	23	103
3	25	21	31	21	98
4	26	27	17	22	92
5	24	18	26	20	88
6	18	17	16	22	73
7	27	12	28	15	82
—	177	146	177	150	650

PROVISIONAL AID TO THE STUDY OF THE TASMANIAN MOLLUSCA.

By R. M. Johnston, F.L.S.

The student of Conchology in Tasmania labours under many disadvantages, owing to the circumstance that the *descriptions* of the various species inhabiting our waters are scattered widely in various publications of Europe and America, while nearly half of the number of the principal *type species* are deposited in foreign museums, and are therefore inaccessible for purposes of reference to local students.

Before we can rest satisfied with the existing classification of many species there is much careful work to be done; for it is well known that the specific descriptions of the earlier distinguished collectors who accompanied expeditions to our seas, are often too meagre to satisfactorily distinguish or separate them from many allied distinct species subsequently discovered. Such accidental collections, too, very naturally contain many forms belonging to widely variable species, and the individuals, of necessity taken by them as types, do not always present the most suitable characters which would serve to distinguish the central type of a widely variable species, and hence the local observer, unable to refer to original types described, is often puzzled or uncertain in his determinations.

It would be well, therefore, to follow the example of New Zealand, in making up a duplicate collection of our shells as complete as possible, and thereafter submit one of them to a well-known European authority like Ed. Von Martins, who would critically examine and compare them with original types in European collections, and submit a critical report for the guidance of local workers. Such a course has already been adopted by New Zealand under the guidance of Professor Hutton, one of the ablest authorities, and certainly one of the most energetic naturalists in Australasia; an example which Tasmania would do well to follow. If Messrs. Legrand, Petterd and Beddome, who have so ably worked in this branch of science in Tasmania, and who possess the best local collections, were to engage in a work of this kind under the auspices of the Royal Society of Tasmania, I am satisfied that the very best results would be attained, and we would then prepare the way for the publication of a work on Tasmanian Mollusca that we could place thorough dependence upon.

It will be observed that although the whole of the 716

known species contained in the list prepared by me were described by over 75 distinct authors at different times and in various publications, yet the greater half (384) were described by five persons, and among these the Rev. J. E. Tenison-Woods alone described 212 species, or nearly a third of the whole. Following next in order to the work of this gifted naturalist last named (whose death, recently, is a loss which all Australasians most deeply deplore), come the names of Lamarck, Reeve, Sowerby, Petterd, Cox, Deshayes, Brazier, Quoy, A. Adams, Gray, Beddome and Angas, all of whom score double figures as regards the number of species described by them respectively.

My own contributions to local Conchology hitherto have been mainly confined to the Fossil Mollusca, although I have been enabled to give the results of long extended observations, and have added 9 new species to the list, in various papers contributed at different times to this Society. Taking the names of Tenison-Woods, Petterd, Cox, Brazier, and Beddome, as local workers, we have some reason to be proud of their accomplishments, for although later in the field, and only numbering 5 out of the 75 authors of species, they have between them described nearly half the number of all the known Tasmanian species.

The labours of the Rev. J. E. Tenison-Woods, F.L.S., etc., deserve special reference, for his writings in all branches of Australasian Natural History are so numerous and valuable that they form in themselves a considerable library. Apart from his many works published in the proceedings of kindred societies in Australia and New Zealand, his interesting volume published many years ago on the Geology of South Australia, and his fine work on the Fishes and Fisheries of New South Wales, he has contributed no less than 31 important communications to the Royal Society of Tasmania, four of which form the chief source of our information concerning the marine and fresh water shells of this Island.

Nor must we forget the labours of another local worker, who although not appearing among the authors of species, has perhaps done more for the science of Conchology in this island than any other single person. I refer to Mr. W. Legrand. This indefatigable naturalist may truly be regarded as the Pioneer of Conchology in Tasmania. He, assisted by Dr. Cox and Mr. Brazier, published the first really important work on Tasmanian Conchology in the year 1870 (Monograph of Tasmanian Land Shells), which afterwards formed the principal part of Mr. Petterd's later monograph on the same subject, published in the year 1878. Nor were Mr. Legrand's labours confined to the land shells. For many years he was the only person who possessed an extensive knowledge of our

local mollusca; and such was his enthusiasm and industry in the investigation of the Conchology of Australia generally, that Mr. Woods regarded his collection in the year 1875 to be the "finest in the southern hemisphere;" and writing in acknowledgment of the great services which he rendered to himself in the preparation for his census of Tasmanian shells, published in 1877, by generously placing at his disposal the whole of his fine collection, and by affording him the greater benefit of his vast store of local information, he refers to Mr. Legrand's monograph in the following terms:—"Within the last few years Mr. W. Legrand has published a monograph of all the (then) known land shells, accompanied with extensive notes on the habits, and very excellent figures of the newer species. What gave the work a greater value, was that it was for the most part privately printed by the author. The whole of the work being done by his own hand."

Next in order of time to Mr. Legrand comes Mr. Petterd. Mr.W. F. Petterd, C.M.Z.S., is a native of Hobart, Tasmania, whose name will ever stand a credit to the land of his birth. Almost self-taught in natural history, he has by natural talent accomplished more and better work than many of the European Naturalists, who have had the advantages of immediate reference to the stored and classified collections of the world's great observers. Mr. Petterd is undoubtedly the "Tam Edwards" of Tasmania. His love for natural history as a youth fortunately attracted the notice of our veteran Conchologist, Mr. Legrand, to whom Mr. Petterd, with many others—myself among the number—owe a lasting debt of gratitude for the kindly help and encouragement always readily bestowed.

Mr. Petterd's keen perception, bright intelligence, and taxidermical skill, combined with a rare facility for depicting the objects which interested his attention by artistic drawings, soon gave him a wide and thorough command of the principal forms of local natural history in Tasmania. Nor were his observations and collections of natural objects confined to his native country. He travelled as an observer widely over Australia, from Cape Howe to the Gulf of Carpentaria, and was one of the early pioneer explorers of New Guinea and the Islands of the Pacific. His splendid collections made in all these regions have largely increased our store of knowledge and have enriched the principal Museums of Europe, Australia and America. As a Conchologist he is best known by his fine "Monograph of the Land Shells of Tasmania," read before this society and published in the year 1879. This work has deservedly obtained for him the widest reputation. His contributions on Conchology to the Royal Society of Tasmania since that time have greatly extended our knowledge,

and he is now, I believe, engaged upon an elaborate treatise on the shells of Tasmania, which will in the future be the standard work of reference to Tasmanian students.

The labours of Lieut. C. E. Beddome have also added largely to our knowledge, and his contributions respecting new forms (17 species), brought to light by his extensive dredging investigations, come very close to those of Mr. Petterd. Mr. Beddome has also contributed several interesting papers to this Society on Conchology, and he is now the possessor of one of the finest collections in Australasia. He prepared a splendid classified collection of our shells for the Fisheries Exhibition held in London in the year 1887, for which he was awarded First Prize and a Gold Medal.

Nor must we forget in this place the valuable work of the Rev. H. D. Atkinson, of Circular Head. This gentleman has for many years been a most enthusiastic collector. Some of the most interesting forms contained in the Rev. J. E. Tenison-Woods' "Census," were brought to light by Mr. Atkinson, who was the first person in Tasmania who extended his researches into the deeper waters by means of the dredge. At the time Mr. Woods was preparing his "Census," Mr. Atkinson was the only person in Tasmania who sought for novelties in this way.

The labours of Mr. B. Dyer, of Hobart, Mr. R. Gunn, and Mr. A. Simson, of Launceston, as collectors, are also worthy of special notice in this place.

Since the appearance of the Rev. J. E. Tenison-Woods' Catalogue of Tasmanian Shells, valuable critical emendations have been made by Prof. Tate and Mr. John Brazier, and these have been availed of by me in the preparation of the Classified List attached to this paper. These gentlemen have also largely contributed in the extension of our knowledge of the Mollusca. Mr. Brazier's contributions to our knowledge of the land and fresh water shells are especially extensive.

In the following pages I have given a fairly comprehensive account of the bibliography of the subject, and for the convenience of local students who are not in possession of works of reference, I have added a part devoted to the description of the various families, mainly based upon the late G. W. Tryon's splendid work on "Structural and Systematic Conchology," (April, 1884.) To afford additional facilities to such students, I have also prepared an artificial key to the classes, families, and genera, which I hope will prove to be of service. In the preparation of this key, I have been greatly aided by a similar key prepared by Prof. Hutton for his excellent work on the Conchology of New Zealand, (Manual of the New Zealand Mollusca,) published in the year 1880.

In conclusion, I may add that this contribution can only be

considered merely as a provisional aid to students of Tasmanian Conchology; but it is hoped it may serve a useful purpose until such time as a more complete work makes its appearance. No doubt it is possible I have failed to notice recent minor contributions which may have appeared in foreign publications, and in the compilation from so many sources, I may have allowed some errors to creep in, but I think these are few and unimportant, and will not materially interfere with its general usefulness.

ARTIFICIAL KEY TO THE FAMILIES.

I. MARINE UNIVALVES.

GASTEROPODA.

(1.) Shell regularly spiral.

(*a.*) *Shell fusiform, tapering to each end, moderately large.*

Large anterior canal, short, recurved, varices not more than 5	Tritonidæ, viii.
Canal straight, short, varices three or more	Muricidæ, vii.
Canal usually straightish and long, no varix	Fusidæ, ix.
Shell notched in front, ovately fusiform	Buccinidæ, x.
Shell with columella plaited, polished aperture, nearly as long as the shell, narrow	Volutidæ, xii.
Columella plaited, aperture small, narrow, not exceeding half the length of shell	Mitridæ, xiii.
Columella plaited, aperture oblong, whorls cancellated, last one inflated	Cancellaridæ, xvii.
Shell small, inner and outer lip crenulated interiorly	Columbellidæ, xvi.
Shell small, somewhat ventricose and rugose, inner lip with a posterior shining callosity, or blunt dentiform plait, anterior canal short, reflected truncate	Nassidæ, xi.

(*b.*) *Shell convolute, the aperture nearly as long as the shell.*

*Spire moderate.

Spire and columella lip covered with enamel, shining	Olividæ, xv.
Small, collumela plaited, outer lip thickened in middle	Marginellidæ, xiv.
Small, columella plaited, aperture, rounded in front	Tornatellidæ, liii.

Small, columella plaited or toothed, spire short	Auriculidæ, lxiv.
**Spire very short.	
Aperture with a recurved canal	Cassididæ, xxii.
Shell inversely conical	Conidæ, xx.
*** Spire none.	
Oval, aperture narrow	Cypræidæ, xxi.
Shell cylindrical, small	Cylichnidæ, liv.
Small, white, pellucid, last whorl expanded	Philinidæ, lii.
Moderate or large, inflated	Bullidæ, lv.
Like *Bullidæ*, shell thin, *flexible*	Lophocercidæ, lvi.
(c.) Shell turreted, elongate or subulate.	
Outer lip indented near the suture, canal long and straight	Pleurotomidæ, xix.
Shell elongated, polished, richly coloured, shelly operculum	Phasianellidæ, xliii.
Whorls ribbed, sutures deep	Scalaridæ, xxvi.
Aperture channeled in front, subulate	Cerithiidæ, xxxiv.
Aperture with an oblique notch in front	Terebridæ, xviii.
Shell awl-shaped, spirally striate, aperture rounded	Turritellidæ, xxviii.
Very small, milk white, polished	Eulimidæ, xxx.
Very small, slender, many whorled, whorls plaited	Turbonillidæ, xxxi.
Very small, aperture oavte, columella truncate	Planaxidæ, xxxiii.
Very minute, elongate, whorls flattish, covered with brownish epidermis	Rissoeliidæ, xxxv.
Very small, aperture entire, often umbilicated, columella smooth	Part Rissoidæ, xxxvi.
(d.) Shell globular or turbinated.	
Polished, aperature semi-circular	Naticidæ, xxiii.
Aperture semi-circular, columella flat	Neritidæ, xl.
Shell thin, blue	Ianthinidæ, xxvii.
Aperture rounded, not pearly inside	Littorinidæ, xxxii.
Aperture rounded, pearly inside, operculum horny	Trochidæ, xlv.
Like Trochidæ, but with shelly operculum	Turbinidæ, xliv.
(e.) Shell conical, with a flat base.	
Shell not pearly inside, umbilicated	Solariidæ, xxv.
Shell not pearly inside, not umbilicated	Littorinidæ, xxxii.
Shell pearly inside, lip without slit	Trochidæ, xlv.
Shell pearly inside, lip perforated, or with a slit	Pleurotomariidæ, xlvii.
Base with a half cup shaped shelf or plate, apex sub-central	Calyptræidæ, xxiv.

Shell depressed, lenticular	Rotellidæ, xlii.
(f.) Shell oval shaped.	
Interior with a shelly process	Calytræidæ, xxiv.
(g.) Shell depressed or ear shaped.	
Shell depressedly turbinate, umbilicated	Liotiidæ, xli.
Shell ear shaped, thin, fragile, pellucid	Naticidæ, xxiii.
Shell ear shaped, nacreous not perforated	Stomatellidæ
Shell ear shaped, nacreous perforated with holes	Haliotidæ, xlviii.
(2.) Shell irregularly spiral.	
Aperture rounded, entire, or with a longitudinal slit	Vermetidæ, xxix.
(3.) Shell flat or simply conical.	
Conical, curved anterior, margin notched or the apex perforated	Fissurellidæ, xlix.
Conical or depressed, neither notched nor perforated	Patellidæ, l.
Like Patella, but having a projection formed over a siphonal groove on right side	Siphonariidæ, lxvii.
Shell small, translucent trigonal	Aplysiidæ, lvii.
(4.) Shell multivalve.	
Shell composed of eight separate imbricating plates	Chitonidæ, li.
CLASS SCAPHOPODA.	
(5.) Shell tube-like, tapering posteriorly	*Dentaliidæ*, lxviii.

(II.) MARINE BIVALVES.

CLASS PELECYPODA.

(A.) Bivalves cemented to or contained within a shelly tube.

Shell either small, equilateral, cemented to the lower end of a shelly tube, umboes alone visible, as in *Aspergillum*, or wholly contained within a tube as in *Gasterochæna*	Gastrochænidæ, lxix.

(B.) Bivalves not cemented or contained within a shelly tube.

(1.) *Dorsal margin protected by one or more accessory valves.*

Shell gaping at both ends, thin, brittle white, very hard. Borers	Pholadidæ, lxxi.

(2.) *Bivalves lacking accessory valves.*

(a.) Two adductor impressions, nearly equal.

* Pallial line *sinuated.*

†Ligament external.

Very long, sub-cylindrical, straight ends gaping	Solenidæ, lxxii.
Equivalve thick, gaping	Saxicavidæ, lxxiii.
Shell rounded, beaks turned forward; hinge teeth 2—2	Semelidæ, lxxviii.
Compressed, thin ligament, anterior	Tellinidæ, lxxix.
Shell rugosely striated and ribbed, sinus profound	Petricolidæ, lxxxii.
Three diverging teeth in each valve	Veneridæ, lxxx.
†† Ligament internal.	
Small, thick, produced behind	Corbulidæ, lxxiv.
Thin, cartilage with a free ossicle	Anatinidæ, lxxv.
Ligament in a triangular pit; two cardinal teeth	Mactridæ, lxxvi.
Ligament in a triangular pit; one cardinal tooth	Paphiidæ, lxxvii.
Hinge with many teeth in a line, inside pearly	Nuculidæ, xcii.
** Pallial line *simple*.	
† Ligament external.	
Trigonal, radiately ribbed, inside pearly	Trigoniidæ, xci.
Radiately ribbed, cordate not pearly	Cardidæ, lxxxiii.
Thin, orbicular, white, divaricating striæ	Lucinidæ, lxxxv.
Inequivalve thick, attached by left umbo	Chamidæ, lxxxiv.
Sub-orbicular, smooth, ligament double submarginal. No lateral teeth	Ungulinidæ, lxxxvi.
Minute, thin, sub-oval, usually transparent	Erycinidæ, lxxxvii.
†† Ligament internal.	
Large, solid, oblong, ventricose, attenuate behind, smooth or concentrically furrowed	Crassatellidæ, lxxxviii.
Roundly ovate, strongly radiately ribbed	Astartidæ, lxxxix.
Hinge, many teeth in a line, not pearly	Arcidæ, xciii.
Hinge, many teeth in a line, pearly inside	Nuculidæ, xcii.
(*b.*) Two adductor impressions, very unequal, umbones anterior.	
Shell equivalve, oval or elongated, inside pearly	Mytilidæ, xciv.
Shell large, equivalve wedge shaped, thin, brittle	Pinnidæ, xcvi.
Shell small, eared, thin, transparent, or having pearly interior, often gaping	Aviculidæ, xcv.
(*c.*) One adductor impression.	
Shell irregular, radiately ribbed, spiny, usually 2 hinge teeth in each valve	Spondylidæ, xcvii.

Shell inequivalve, upper one flat, no teeth	Ostreidæ, ci.
Shell thin, perlaceous, with a deep notch or hole in the inferior valve, attached	Anomiidæ, c.
Shell eared, sub-orbicular, radiately ribbed	Pectinidæ, xcviii.
Shell eared, white, gaping at the sides, equivalve often minute	Limidæ, xcix.
(C.) Shell globular, three lobed, concentrically striated, open in front and behind, lodged at the extremity of a shelly lined tube or burrow	Teredidæ, lxx.

CLASS BRACHIOPODA.

(D.) Shell round or oval, perforated near or at the apex. minutely punctate	Terebratulidæ, cii.

(III.) LAND AND FRESH WATER MOLLUSCS.

(A.) Land Slugs, or Snails; shell none, or rudimentary.

Shell rudimentary, a calcareous plate concealed under the mantle, jaw of animal without ribs	Limacidæe, lxi.
Shell rudimentary, often composed of a few calcareous grains, jaw of animal strongly ribbed	Arionidæ, lxii.

(2.) *Land Snails, with shell more or less spiral and fully developed.*

Shell small, oval, with short spire, fragile, whorls few, rapidly enlarging, resembling some fresh water *Lymnæa*	Succineidæ, lxiii.
Shell usually thin, corneous, transparent, plaits spiral, of few rapidly enlarging whorls, animal too large to entirely enter	Vitrinidæ, lviii.
Shell of variable form, large or very minute, smooth, rugose, striated ribbed or cancellate, sometimes pilose, orbicular planoid convex, planorboid trochiform (Helix Launcestonensis) sub-turriculated or short—Helix—shell large, oblong, spiral (Bulimus)	Helicidæ, lix.
Shell minute, multispiral, cylindrical, with obtuse summit, pupiform, aperture small, usually contracted by internal teeth or lamellæ. Whorls reversed in local example	Pupidæ, lx.

(B.) Fresh water or sub-aquatic, nearly all more or less covered with a dark brownish epidermis.

(a.) Spiral univalves.

* Sub-aquatic.

Shell minute, cylindrical apex, truncated whorls, striated transversely—margins of sea shore	Truncatellidæ, xxxix.
Shell, smooth, elongated, perforated, whorls very convex, aperture round, peristome slightly expanded or reflected, apex frequently decollate. (Pomatiopsis)	Part Rissoidæ, xxxvi.

** Aquatic.

(1.) † *Shell very minute, depressed, conical or umbilicated*	Valvatidæ, xxxviii.
(2.) †† *Shell very minute*, 4 to 6 whorls, *sub-umbilicated*, elongate, ovate or pupiform (Bithynella), turbinately ovate, inner lip more or less reflected. (Beddomeia)	Part Rissoidæ, xxxvi.
Shell minute, turbinately elongate, sub-perforate. (Hydrobia.)	
(3.) ††† Shell small, globosely rounded, ovate imperforate, inner lip thickened. (Brazieria.)	
(4.) Shells found in or near brackish water. Small, minute, globosely conical, sharp lip	Assiminiidæ, xxxvii.
Shell, moderate, sub-globose, banded	Amphibolidæ, lxvi.
Elongate, minute, pyramidal pointed spire, flattish whorls. (Tatea.)	Rissoellidæ, xxxv.
(5.) Shell moderate size or minute with sharp spire more or less acuminate; columella lip with oblique plait above, oval, oblong, corneous translucent, dextral. (*Limnæa.*)	Part Limnæidæ, lxv.
Sinistral. (*Physa.*)	
Shell very minute, discoidal bi-concave. (*Planorbis.*)	
(b.) Non-spiral, pateliform or conical, base, partly closed by a flat shelf, leaving a semi-lunar aperture, apex inclined to the right. (*Gundlachia.*)	Part Limnæidæ, lxv.
Shell aperture simple, entire, conical, limpet-shaped, sometimes radiately ribbed. (*Ancylus.*)	

(c.) Bivalve shells minute, ovate, thin, olive or white. (Pisidium) Minute, sub-quadrate, thin, yellowish. (Sphærium or Cyclas.)	Cyrenidæ, lxxxi.
Shell, large, oblong-oval, blackish epidermis; umboes eroded, pearly inside	Unionidæ, xc.

List of the Various Authors who have Described More than one Local Species, Arranged According to the Order of their Importance Locally.

	Species Described. No.
1. Tenison-Woods	212
2. Lamarck	59
3. Reeve	39
4. Sowerby	37
5. Petterd	37
6. Cox	29
7. Deshayes	23
8. Brazier	19
9. Quoy	18
10. A. Adams	18
11. Gray	17
12. Beddome	17
13. Angas	15
14. Crosse	10
15. Linne	9
16. Johnston	9
17. Adams and Angas	9
18. Swainson	9
19. Pfeiffer	8
20. Quoy and Gaim	8
21. Tate	5
22. Chemnitz	5
23. Dunker	5
24. Martyn	4
25. Born	3
26. H. and A. Adams	3
27. Gmelin	3
28. Philippi	3
29. Hinds	3
30. Kiener	3
31. Stutchbury	3

32. Hanley	3
33. Frauenfield	2
34. Menke	2
35. Mueller	2
36. All others	63
Total	716

CLASSES, FAMILIES AND GENERA.

Descriptive Account of the Various Classes, Families and Genera of Molluscs Inhabiting Tasmania, Systematically Arranged According to Tryon, ("Structural and Systematic Conchology, 1884."

NOTE.—The Roman numbers refer to the number of the family, and the Arabic numbers in brackets to the number of the species; both arranged in consecutive order in the systematic list.

Class CEPHALOPODA.

Cuttle Fish, Squids, Nautili, etc.

Head large, separate from the body; eyes large, lateral; ears developed; mouth with two *horny or shelly beak-like jaws* with fleshy lips, and surrounded by *eight or ten fleshy arms or numerous* tentacles, furnished with an entire or slit tube, used in locomotion, which is usually directed backwards in swimming.

SYNOPSIS OF FAMILIES.

A. Order Dibranchiata.

Animal breathing by a *single pair* of symmetrical branchiæ or gills; *eyes sessile; shell internal or none; mandibles horny*; arms with suckers.

Sub-Order Octopoda.

Arms, eight; no shell, (the so-called shell of the argonaut is the egg nest of the female.)

	Family
Sessile	Octopodidæ
Suckers slightly *pedicelled*; female having two of the upper arms expanded into broad webs, one of which secretes an egg nest (nautiliform shell.)	Argonautidæ

(i.) Family Octopodidæ.

Mantle supported by fleshy bands; no ceptralic aquiferous pores; arms subulate, elongated, more or less united by webs, their *suckers sessile.*

SYNOPSIS OF GENERA.

(1.) *Arms with two rows of suckers*	*Genus.*
(a.) Body not finned.	
Body *rounded*; arms long; suckers sessile; *third right arm of male* hectocotylised	Octopus (1.)
Differs from Octopus in having a small aquiferous system, consisting of a bag with a small pore at its lower edge upon the web between each arm	Cistopus (—)
Body *oval*, wider than head; arms short; cups with narrowed bases; third *left* arm hectocotylised	Scæurgus (—)
Arms united by a web nearly to the ends	Alloposus (—)
(b.) Body Finned.	
Body like Octopus, but finned; arms with two rows of suckers	Pinnoctopus (2)
(2.) *Arms with a single row of suckers*	
(a.) Not Finned.	
Body rounded, without fins; third right arm hectocotylised	Eledone (—)
More gelatinous than Eledone; suckers smaller, less developed	Bolitæna (—)
(6.) *Finned.*	
Body with two transverse medial fins; mantle united to the head nearly all round by a conical band; arms united by a web nearly to the tips	Cirroteuthis (—)
(3.) *Arms with three rows of suckers.*	
Body not finned.	Trixaxeopus (—)

(ii.) Family Argonautidæ.

Mantle supported by two buttons fitting into grooves at the base of the siphuncle; the two upper or dorsal arms (in the females only) expanding into broad webs at their extremity, from which an egg-nest (shell) is

secreted; cups slightly pedicelled; a pair of aquiferous pores at the upper hinder angle of the eye.

Genus.

Characters those of the family; the third right arm of the male is hectocotylised; shell thin, translucent; nautiliform, white, usually two nodose keels at periphery — Argonauta (3)

Sub-Order DECAPODA.

Ten arms, of which *eight are sessile*, and *two* (longer) *tentacular*; shell internal.

(1.) *Internal shell horny.*

(*a.*) Eyes *covered by skin*; mostly littoral species.

Family

Body long; tentacular arms, partially retractile — Loliginidæ

Body short; tentacular arms, completely retractile — Sepiolidæ

(*b.*) Eyes *naked*; Pelagic species.

Body long, cylindrical; arms or tentacles armed with *hooks* — Onychoteuthidæ

Body long, cylindrical; arms with *suckers* only — Ommatostrephidæ.

(2.) *Internal shell calcareous.*

(*a.*) Shell blade like — Sepiidæ

(*b.*) Shell forming a series of chambers transversed by a siphon — Spirulidæ

(iii.) Family Loliginidæ.

Body rather long; buccal skin sometimes armed with suckers; tentacular arms only partially retractile; fins lateral, terminal; inner shell or *gladius as long as the back*. (Calamary.)

Genus.

Body long, with posterior rhombic fins united behind; mantle supported by a cervical ridge, and by cup-like cartilages on the base of the funnel or siphon; siphon valved, attached by bands to the head; arms with two rows of suckers, provided with *horny dentated rings*; tentacular arms with *four rows* of suckers on their clubs; fourth

		Genus.
Body	left arm hectocotylised at its extremity; gladius feather-like, its shaft keeled on the ventral side rather long or oval, with small lateral fins extending its entire length; siphon attached to the head by muscular bands; buccal skin with *seven* projections covered with suckers; a strong wrinkle behind the eyes; otherwise like *Loligo*	Loligo (—) Sepioteuthis (6)

(iv.) Family ONYCHOTEUTHIDÆ.

Body long, cylindrical; mantle supported by cartilaginous projections; eyes with a lachrymal sinus; arms or tentacles *armed with hooks*; siphon with or without bands and valve; gladius or shell generally lancet form, with *end-conus*

		Genus.
Arms	with two rows of suckers; rings not toothed; tentacles thick; *clubs armed with two rows of strong hooks*; bases of the same also strongly hooked; gladius or shell lancet form, with a conical commencement	Onychoteuthis (4)

Family OMMATOSTREPHIDÆ.

Arms	*short*, with two rows of suckers; tentacles short, not retractile; the clubs armed with *four rows of suckers;* siphon valved, fastened to the head by bands; shell lancet form, with a hollow end, conus	Ommatostrephe (5)
Club	arm armed with a combination of smooth-rimmed suckers and tubercles	Architeuthis (—)

(A gigantic group of cephalapods.)

(—) Family SEPIIDÆ.

Eyes covered by skin; littoral. Body oval, with long lateral fins, uniting behind; mantle supported by *cartilaginous tubercles*, fitting into sockets on the neck and siphon; arms with suckers; tentacular arms entirely retractile; siphon valved; shell (cuttle bone, sepion, or sepiostaire,)

broad, flat, thickened internally by numerous plates, terminating behind in a hollow, imperfectly chambered, apex or mucro, without connecting siphon.

Genus.

A lid-like fold under the eyes with lachrymal openings over them; six aqueous pores in the buccal membrane; arms short; tentacles long, suckers long, pedunculated; siphon with very large valve; fourth left arm hectocotylised to its base, (one or two species undetermined abundant in Tasmanian waters) — Sepia (—)

Differing from Sepia by the sessile arms having only two rows of suckers — Hemisepius (—)

(v.) Family Spirulidæ.

Animal, body oblong, with minute terminal fins; mantle supported by a cervical and two ventral ridges and grooves; arms with six rows of minute cups; tentacular arms elongated; siphon valved; *shell* laxly spiral, pearly whorls on the same plane, not in connection, chambered; chambers connected by a ventral siphon, invested by a series of cone-shaped tubes, one for each chamber; shell is placed vertically in the end of the body, and is held in place by side flaps of the mantle.

Genus.

Characters same as those of family — Spirula (7)

(B.) Tetrabranchiata.

Animal breathing by *two pairs* of symmetrical branchiæ; *eyes pedunculated*; mandibles *shelly*; arms very numerous, *without suckers*; shell external, chambered; capable of containing the animal.

(vi.) Family Nautilidæ.

Septa simply curved, concave on the outer face; sutures simple, or undulate, or lobed; mouth simple; siphonal opening nearly central; shell often banded with colour, pearly inside. (Six living, and over 2,000 fossil species.)

Shell involute, discoidal few-whorled; septa concave, simple; siphuncle nearly central. Dist.—Tropical seas. Australia and Tasmania — Nautilus (8)

Class GASTEROPODA. (vii.-lxvii.)

Head distinct, usually furnished with eyes and tentacles; body mostly protected by a *spiral* or *conical univalve shell*; lower surface of animal developing a thickened, expanded, creeping disc or foot.

Sub-Class PROSOBRANCHIATA. (vii.-li.)

Sexes separate in different individuals. *Mostly marine animals*, provided with a shell and generally an operculum, embraces at least all operculated molluscs. Animals breathe by *gills or branchiæ*.

Sub-Class OPISTHOBRANCHIATA. (lii.-lvii.)

Marine slugs breathing by *arborescent or fasciculated branchiæ*, more or less exposed on back and sides posteriorly; a large division shell less, another possessing a spiral, conical or lamellar shell partly concealing branchiæ and itself *more or less concealed by mantle lobes. Sexes united.*

Sub-Class PULMONATA. (lviii.-lxvii.)

Mostly terrestrial (land shells), a portion being fluviatile (fresh water), usually provided with a *shell without operculum*, breathing air by the *simplest form of lung*, a pouch with external opening, lined with a net work of respiratory vessels. Sexes united in the same individual.

Class SCAPHOPODA. (lxviii.)

Shell or *hollow cylinder*, straight or curved without spire, open at both ends. Head rudimentary; foot vermiform, lobulate; nervous system simplified, resembling that of the pelecypods or lamellibranchs.

Class PELECYPODA. (lxix.-ci.)

(*Lamellibranchiata* Conchifera, Bivalves.)

No head nor eyes. Animals breathing by lamellæ, two on each side, mostly diæcious head with two chambers;

nervous system, gills with three principal pairs of ganglia. No sexual union, fertilisation being accomplished by the surrounding water containing the male element. Shell composed of two valves hinged together, but occasionally (Barnea) with smaller supernumerary pieces about the hinge.

Order SIPHONIDA. (lix. to lxxxix.)

Animal *with siphons*, and mantle margins more or less closed; comprises most of the marine branchiæ, including a large portion of the old order *Dimyaria*—having *two well developed muscular impressions.*

	Sub. order.
Siphons *long*, partly or wholly retractile; the pallial impression upon the inside of valve *with a sinus.*	Sinupalliata (lxix. to lxxx.)
Siphons *short, not retractile*; pallial impression *simple without sinus.*	Integripalliata (lxxxi. to lxxxix.)

Order ASIPHONIDA (xc.-ci.)

No siphons; pallial impression *without sinus*; mantle margin open.

	Sub. order.
Two muscular impressions equally distinct; mantle margins open or closed behind.	Homomyaria (xc. to xciii.)
Two unequal muscular impressions; *posterior* impressions *large*, anterior impression *very small*; frequently *inequivalve.*	Heteromyaria (xciv. to xcvi.)
A single posterior or sub-central adductor muscle and impression *only*	Monomyaria (xcvii. to ci.)

FAMILIES, GENERA AND SUB-GENERA.

(vii.) Family MURICIDÆ.

Shell spiral; turriculated with an *anterior* canal; the whorls thickened by varices or nodules at each rest period in its growth.

Genus MURREX. Linn. (9-11.)

Shell ovate or oblong; spire prominent; whorls convex crossed by three or more continuous varices; aperture ending below in a canal, which is generally partly closed.

Genus UROSALPINX. Stimpson. (12.)

Syn Adamsia, Agnewia.

Shell fusiform; not variced; longitudinally ribbed or undulated and spirally striated; aperture with a short canal; outer lip dentate, lirate within. Operculum semicordate, nucleus marginal.

Genus TYPHIS. Montfort. (13.)

Shell ovate or oblong, with *numerous projecting hollow tubular spines* between the three varices; aperture nearly round, produced in front into an *enclosed siphonal canal*; operculum ovate with apical nucleus.

Genus TROPHON. Montfort. (14-22.)

Shell large, broadly fusiform, usually shouldered and umbilicate; with numerous lamelliform or laciniated varices, spire prominent; aperture ovate, lips thin; canal open, *usually turning to the left*; shell *white* without, but often dark within.

Genus PURPURA. Bruguiere. (23-28.)

Syn.—Microstoma. Thais.

Shell oblong-oval, *last whorl large*; spire usually short; columella flattened; aperture ovate, large, terminating in a very short oblique channel, or notched; outer lip simple. *Dist.*—Low water to 25 fathoms.

(viii.) Family TRITONIDÆ.

(Shell with varices which are either few and irregularly distributed, or form a continuous row crossing the whorls on opposite sides.)

Genus TRITON. Montf. (29-33.)

Syn.—Tritonium, Charonia, Aquilus, Lampusia, Ranularia

Shell oblong with prominent spire; whorls with a few remote non-continuous varices; columella rough or smooth; canal recurved; outer lip crenate or denticulate; operculum ovate with sub-marginal nucleus. *Dist.*—Low water to 50 fathoms.

Genus RANELLA. Lam. (34-36.)

Shell ovate or oblong, compressed; varices two, continuous, one on each side; *columella arcuated, ridged or crenulate*; aperture oval; outer lip crenated; canal short, recurved; operculum ovate, horny, with lateral nucleus, *Dist.*—Reefs and deep water.

Family ix. Fusidæ.

(Shell more or less spindle-shaped, *without varices*; the lip of aperture not thickened.)

Genus Fusus. Lamarck. (37-42.)

Shell fusiform, not variced; spire long, acuminate, many whorled; *columella smooth, without plaits*; aperture ovate, usually striate within; outer lip simple; *canal long and straight*; operculum ovate; acute, with apical nucleus; yellowish brown; sometimes with red brown strigæ or spots, never branded. *Dist.*—World-wide.

Genus Fasciolaria. Lamarck. (43-45.)

Shell fusiform; spire acuminate; aperture oval-elongate, outer lip internally crenate; columella smooth, *with a few oblique plaits*; canal moderate, nearly straight. *Dist.*—World-wide.

(x.) Family Buccinidæ.

(Columella generally without folds or plications.)

Genus Siphonalia. Adams. (46-48.)

Shell ovately fusiform, sometimes variegately coloured, thin with very thin fugacious epidermis; last whorl ventricose, shouldered usually nodosely, plicate and spirally ribbed; aperture oval; outer lip thin; columella smooth; *canal rather short, twisted*; operculum ovate, with apical nucleus. *Dist.*—Japan, California, Australasia.

Genus Cantharus. Bolten. (49.)

Syn. Tritonidea.

Shell bucciniform, more or less ventricose in the middle, narrow anteriorly; *spire and aperture nearly equal*; columella generally with a few transverse ridges; outer lip internally crenated with a superior siphonal canal; operculum ovate, with apical nucleus.

Genus Pisania. Bivona. (50-51.)

Shell oblong, with prominent spire; whorls smooth or spirally striated; canal very short; outer lip thickened and crenated; operculum ovate, with apical nucleus. *Dist.*—West Indies, Mediterranean, Philippines, Australasia.

Genus Cominella. Gray. (52-59.)

Shell bucciniform, marked or spotted, *covered with an epidermis*; spire short, acute; last whorl large, ventricose,

with a *posterior depressed groove at the suture, producing a contraction at the hind part of the outer lip*; operculum with apical nucleus. The sub-genus *Josepha*, T.-Woods, differs from Cominella in possessing a plait upon the columella. *Dist.*—Cape, Australasia.

Genus EBURNA. Lam. (60.)

Shell ovate-oblong, thick, porcellanous, under a thin epidermis; *deeply umbilicated*; spire acuminated; whorls more or less convex, *suture more or less channeled*; columella arcuated; callous posteriorly; aperture oval, inner lip spreading, *often covering the umbilicus* in the adult; outer lip simple acute; operculum with apical nucleus. *Dist.*—Red Sea, India, Cape, Japan, China, Australasia.

(xi.) Family NASSIDÆ.

(Base of aperture with a notch or short recurved canal; inner lip callous.)

Genus NASSA. Lam. (61-65.)

Shell small, ovate; ventricose; body whorl variously sculptured; aperture ovate, with a short, reflected, truncated, anterior canal; inner lip smooth; *often widely spread over with enamel*, with a *posterior callosity* or blunt, dentiform plait; outer lip dentated, internally crenulated; margin of operculum, serrate or entire. *Dist.*—World-wide.

(xii.) Family VOLUTIDÆ.

Genus VOLUTA. Linn. (66-72.)

Shell ovate or sub-conical, thick, solid; *spire usually short*; (Shoulder of whorls often angulated, sometimes nodose or spinous, but not so characterised in the Tasmanian living species.) Aperture—extending the *greater length of shell*—long and rather narrow; columella with a callous deposit and *prominently plaited*; lip generally thickened, sometimes sub-reflected. *Dist.*—World-wide, Australia being the chief centre.

(xiii.) Family MITRIDÆ.

Genus MITRA. (73-86.)

Shell fusiform thick; spire elevated; *aperture small*, generally *less than half the length of the shell, narrow*, notched in front; columella *transversely, somewhat obliquely plicate;* outer lip thick, smooth within, not variced externally. *Dist.*—Tropical and sub-tropical; range low water to 80 fathoms.

(xiv.) Family Marginellidæ.

Genus Marginella. Lam. (88-96.)

Shell smooth, bright; spire short or concealed; aperture obtuse or truncated in front; *columella plaited*; *outer lip* (of adult) *with a thickened marginal varix*; inner margin smooth or crenulate. *Dist.*—Tropical and sub-tropical.

Genus Erato. Risso. (87.)

Shell obovate, polished; spire short, conical, distinct; aperture linear; *outer lip without varix*, but *thickened towards the middle*, and denticulate within; columella with *distinct plaits at the fore part*. *Dist.*—World-wide.

(xv.) Family Olividæ.

(Shells sub-cylindrical, porcellanous, brilliant in colour; columella lip, sutures and spire more or less covered with a callous deposit; outer lip simple, notched below.)

Genus Olivella. Swainson. (97.)

Shell *small*, polished, sub-cylindrical, solid; *spire produced*, acute; suture canaliculate; aperture narrow behind, enlarged anteriorly; columella plicated in front, callous posteriorly; *operculum present*, thin, half ovate with apical nucleus. *Dist.*—N. America, China, Australasia, etc.

Genus Oliva. Brug. (98.)

Shell oblong, sub-cylindrical, polished; *spire short, conical*; suture canaliculate; *aperture long, narrow*, anteriorly widely notched; columella obliquely plicate; sulcate or striate in front; callous posteriorly; outer lip simple; operculm wanting. *Dist.*—America, Africa, India, Polynesia, Australasia.

Genus Ancillaria. (99-101.)

Shell oblong, polished, sub-cylindrical; body whorly, swollen; sutures covered by enamel; aperture broadly effuse below; columella not umbilicated, with a few oblique anterior plaits; basal whorl marked with revolving grooves which terminate occasionally in a slight anterior lip projection or tooth; *operculum generally present, small, ovate, acute*. *Dist.*—Red Sea, Indian Ocean, Japan, West Indies, Australasia.

(xvi.) Family COLUMBELLIDÆ.

Genus COLUMBELLA. Lam. (102-113.

Shell strombiform, mitriform, or fusiform (usually fusiform, with elevated spire in Tasmanian species), smooth, or longitudinally or transversely ribbed; internal lip excavated in middle, *crenulate or denticulate in front*; outer lip *inflected and internally thickened and crenulate in the middle*. *Dist.*—Mostly sub-tropical. (Oat shell.)

(xvii.) Family CANCELLARIDÆ.

Genus CANCELLARIA. Lam. (114-117.)

Shell ovately fusiform, *cancellated*, reticulated or ribbed; last whorl ventricose; aperture oblong, canaliculate in front; canal short, sometimes recurved; *columella with several large oblique plications*; operculum wanting. *Dist.*—World-wide; range, low water to 40 fathoms (vegetable feeders).

(xviii.) Family TEREBRIDÆ. (Auger Shells.)

Genus TEREBRA. Lam. (118-123.)

Shell *elongate*, *narrow*, *turriculate*, solid; whorls flattish, numerous, with superficially impressed sutures; aperture *small, ovate*. Profoundly notched at the base; columella oblique; operculum annular, horny, with apical nucleus. *Dist.*—Mostly tropical.

(xix.) Family PLEUROTOMIDÆ.

Genus PLEUROTOMA. Lam. (124-152.)

Shell turriculated, fusiform, *terminated anteriorly* by a straight canal, more or less prolonged; aperture generally linear-ovate; columella smooth, straight, or sinuous; outer lip *somewhat sinuous, with a notch or slit near the suture*; operculum corneous, annular, not always present. *Dist.*—World-wide; low water to 100 fathoms.

Sub-Genus DRILLIA. Gray.

Turriculated; aperture oval, oblique, about one-third the length of (adult) shell; canal short, twisted; columella lip strongly callous above.

Sub-Genus BELA. Gray.

Shell oval, fusiform; spire produced; canal short; sinus small near the suture; columella flattened; aperture narrowly ovate, nearly half the length of shell; *operculum pointed at both ends*.

Sub-Genus CLATHURELLA. Carp.

Differs from *Mangelia* in the more ventricose form and more evident canal; from *Clavatula* in the emargination of outer lip; from *Bela* and *Daphnella* in texture and sculpture; shell fusiform or turriculate, cancellated surface; columella lip without callosity, except a small posterior tooth; *no operculum;* aperture nearly half the length of (adult) shell.

Sub-Genus DAPHNELLA. Hinds.

Shell fusiform, *thin, fragile, usually striated;* aperture elongated, oval, usually less than half the length of (adult) shell; canal very short. Small and elegant shells, distinguished from *Defrancia* by their elongated body-whorl tenuity and sculpture. No operculum.

Sub-Genus CITHARA. Schum.

Shell fusiform, *polished, longitudinally ribbed*; aperture linear, truncated in front, slightly notched behind; outer lip *margined, denticulate within: inner lip frequently finely striate*; no operculum.

Sub-Genus MANGELIA. Leach.

Shell fusiform, mostly longitudinally ribbed; spire elongated, turriculate, accuminate; canal short, more or less truncate; columella smooth; aperture usually fully half the length of shell; sinus near the suture; no operculum.

(XX.) Family CONIDÆ.

Genus CONUS. Lam. (153-157.)

Shell thick, obconic; whorls enrolled upon themselves; spire not elevated or short, smooth or tuberculate; aperture elongate, narrow, margins parallel, truncate at base; outer lip with a slight suttural sinus. *Dist.*—Principally developed in the equatorial region.

(XXI.) Family CYPRÆIDÆ.

(Shell *convolute, enamelled*; *spire concealed*; aperture narrow, channeled at each end; no operculum.)

Genus CYPRÆA. Linn. (158-164.)

Shell ventricose, *convolute, covered with shining enamel*; *spire concealed*; aperture long, narrow, with short canal at each end; *inner lip crenulated;* outer lip *inflected* and crenulated.

Sub-Genus TRIVIA. Gray.

Distinguished by being striated over the back, frequently interrupted by an impressed dorsal sulcus.

Sub-Genus CYPRÆ-OVULA. Gray.

Pyriform, oval, ventricose. Surface covered with revolving striæ.

Genus OVULUM. Brug. (165.)

Shell ventricose, convolute, *attenuate, and sub-acuminate at both ends*; outer lip of adult thickened and inflected.

Sub-Genus VOLVA. Bolten.

Distinguished by being ventricose *in middle*, and in having both extremities prolonged into canals.

(xxii.) Family CASSIDIDÆ.

Genus CASSIS. Lam. (166-170.)

Shell sub-globular or triangular, usually solid, thick (Tasmanian species excepted), last whorl large, varicose; aperture longitudinal, narrow; outer lip *with a thickened, reflected margin, dentate within*; inner lip rugosely plicate; operculum oval, narrow, with median apex. *Dist.*—Mostly tropical and sub-tropical; voracious, living in sandy localities, preying upon bivalve molluscs.

Sub-Genus SEMICASSIS. Klein.

Shell oval, with revolving ribs; spine moderate, sharp.

Sub-Genus CASMARIA. H. and A. Adams.

Shell *generally* smooth; *whorls simple or sub-plicate*, spire moderate; inner lip smooth, callous; outer lip margined, smooth or slightly crenulated on the inner edge.

(xxiii.) Family NATICIDÆ.

(Shell globular or oval; spire, usually short; aperture, semi-lunar, *without canal* or *anterior notch*; outer lip sharp; *columella callous, more or less reflected over the umbilicus*; operculum pauci-spiral, corneous, or with an exterior calcareous layer.)

Genus NATICA. Lam. (171-177.)

Shell sub-globular; spire slightly elevated; aperture half round. A *spiral columella callus entering the umbilicus*. *Dist.*—World-wide.

Sub-Genus Mamilla. Schum. (Ruma, H. and A. Adams.)

Shell ovate, conic, *rather thin*, with pointed spire; whorls fasciated; mouth *oblong*; inner lip narrow, reflected; umbilicus *not funiculated*.

Genus Sigaretus. Lam. (178.)

Shell *ear-shaped*, with minute spire, and very large aperture, externally *with revolving striæ*; colour usually white, with sometimes a thin corneous epidermis; operculum minute, horny, sub-spiral. *Dist.*—United States, West Indies, China, Peru, Australasia.

Genus Lamellaria. Montagu. (179.)

Shell *ear-shaped*, *thin*, *pellucid*, *fragile*; spire very small; aperture large, patulous; inner lip receding; no operculum. *Dist.*—Norway, Great Britain, Mediterranean, New Zealand, Philippines.

(xxiv.) Family Calyptræidæ.

(Shell *limpet-like*, with the apex more or less spiral; interior simple, or divided by a shelly process or plate, variously shaped, to which the adductor muscles are attached.)

Genus Infundibulum. Montfort. (180.)

Syn.—Trochita, Clypeola, Trochella.

Shell conic trochiform, spiral; summit central; whorls convex, plicate not umbilicated; aperture large, containing a spiral, transverse lamina or plate, extending obliquely from the centre to the outer margin of the shell. *Dist.*—Mostly tropical and sub-tropical.

Genus Calyptræa. Lam. (182.)

Shell conical, more or less angular, with sub-central sub-posterior sharp apex; aperture basal, with a central lamina, half-cup shaped, attached to apex and open in front. *Dist.*—World-wide.

Genus Legrandia. Beddome. (181.)

Shell *emarginuliform*; internal plate like *Crepidula*; radiately ribbed; *front edge fissured*. *Dist.*—Tasmania.

Genus Crepidula. Lam. (183-184.)

Shell oval, *limpet-like*, with a posterior generally lateral spiral apex; interior with a shelly plate covering its posterior half. *Dist.*—World-wide.

Genus Hipponyx. Defrance. (185-187.)

Shell thick, obliquely conical, *non-spiral*; apex somewhat posterior and curved backwards; *muscular impression, horse-shoe shaped*; base of attachment shelly. *Dist.*—Almost world-wide.

Sub-Genus Amalthea. Schum.

Like Hipponyx, but *without shelly* base; impression *crescent-shaped.* This form is usually found attached to living shells.

(xxv.) Family Solariidæ.

(Shell *orbicular, depressed, or trochiform*; aperture generally angular; umbilicus usually wide and deep; operculum corneous, spiral.)

Genus Solarium. Lam. (188-189.)

Shell depressed, conical, angular at periphery; aperture, subquadrangular, lip simple; umbilicus wide, spiral, its margins crenulated; operculum horny, sub-spiral. *Dist.*—Tropical, world-wide.

Genus Adeorbis. S. Wood. (190.)

Shell *depressed*, orbicular, widely umbilicated; *whorls not numerous*, smooth or striate, the last somewhat angular; *aperture rounded*, the outer lip arcuate, simple, sharp; operculum shelly, sub-spiral. *Dist.*—West Indies, China, Australasia.

(xxvi.) Family Scalaridæ.

Genus Scalaria. Lam. (191-202.)

Shell mostly white and lustrous; turreted; many whorled; whorls round, sometimes separate, *ornamented with numerous transverse ribs;* aperture round; *peristome continuous;* operculum horny, few whorled. *Dist.*—Mostly tropical.

Sub-Genus Crossea. A. Adams.

Shell *turbinate, umbilicated, white;* whorls convex, *cancellated, simple or with varices;* aperture roundish, anteriorly angular, somewhat produced and canaliculate; umbilicus surrounded and narrowed by a callus. Occurs also fossil in Australia and Tasmania, in rocks of Eocene age.

(xxvii.) Family Ianthinidæ.

Genus Ianthina. Lam. (203-205.)

Shell thin, *translucent, trochiform or globular-turbinate; nucleus minute, styliform, sinistral;* whorls few, rather ventricose; aperture four sided; columella tortuous; lip thin, notched at the outer angle; base of the shell deep violet; spire nearly white. *Dist.*—Pelagic in Atlantic and Pacific Oceans.

(xxviii.) Family Turritellidæ.

Genus Turritella. Lam. (206-210.)

Shell *elongated, awl-shaped,* many whorled, with revolving striæ; *aperture rounded;* operculum, many whorled, with a fimbrated margin, usually whitish or brownish, with sometimes red-brown spots or flames. *Dist.*—World-wide, ranging from Laminarian Zone to 100 fathoms.

(xxix.) Family Vermetidæ.

(G.) Shell (adult) *irregularly spiral, or contorted tubular*; operculate.

Genus Vermetus. Adamson. (211.)

Shell irregularly spiral, adult stage, or contorted, tubular, operculate. *Dist.*—Tropical and sub-tropical. World-wide.

Genus Siliquaria. Brug. (212-213.)

Shell tubular: spiral at first, afterwards irregular; *tube with a continuous slit;* operculum spiral.

(xxx.) Family Eulimidæ.

(Shell turriculated or turbiniform, smooth, milk white, polished; aperture oval or rounded, sometimes angular in front; *columella without plications;* operculum corneous, sub-spiral, when present.

Genus Eulima. Risso. (214-220.)

Shell small, white and polished; slender, elongated, with numerous level whorls; spire often curved to one side; *obscurely marked on one side by periodic mouths,* which form prominent ribs internally; *apex acute*; aperture oval, pointed above; outer lip thickened internally; inner lip reflected over the pillar; not umbilicated; operculum horny, sub-spiral. *Dist.*—World-wide—5 to 90 fathoms.

Genus Stylifer. Brod. (221.)

Syn.—Stylina.

Shell *hyaline*, pellucid, thin, globular or subulate, smooth, polished; whorls numerous; apex very sharp, sometimes bent; *nucleus sinistral*; aperture sub-oval, angulated posteriorly, rounded in front; inner lip smooth, arcuated; outer lip slightly sinuous, thin, simple, no operculum. *Dist.*—Europe, West Indies, Polynesia, Australasia.

(xxxi.) Family Turbonillidæ.

(Shell *white, slender, elongated*, many whorled, *mostly longitudinally ribbed or spirally striate.)*

Genus Turbonilla. Risso. (222-225.)

Shell slender, elongated, many whorled; whorls plaited; *apex sinistral;* aperture simple, ovate; *peristome incomplete; columella not plaited*; operculum horny, sub-spiral. *Dist.*—World-wide. Range from low water to 90 fathoms.

Genus Aclis. Lovén. (226.)

Shell *minute, like Turritella;* usually spirally striated; apex sinistral; aperture oval; outer lip prominent; axis slightly rimate, operculate. *Dist.*—Europe, North America, Australasia.

Genus Odostomia. Fleming. (227-229.)

Syn.—Odontostomia.

Shell subulate or ovate, typically smooth; apex sinistral; aperture *ovate*; peristome *not continuous*; columella *with a single tooth-like fold*; operculum horny, indented on the inner side. *Dist.*—Universal, from low water to 40 fathoms.

Sub-Genus Parthenia. Lowe.

Shell thin, turriculate, imperforate, usually milk white, under a very pale, thin, epidermis; whorls ribbed or striate, sometimes cancellate, vanishing at periphery of last whorl. *Dist.*—Japan and Tasmania.

Genus Elusa. A. Adams. (230.)

Shell *subulate, turreted; whorls longitudinally plicate;* aperture *ovate;* inner lip with a single plait; outer lip often lirate within. *Dist.*—China, Japan, Australasia.

Genus Syrnola. A. Adams. (231-232.)

Shell subulate, *straight*, vitreous, *banded, polished;* whorls flat; *suture impressed*; aperture *oblong;* inner lip acute, *obliquely plicate in the middle;* outer lip simple, acute.

Genus EULIMELLA. Forbes.

Sub-Genus STYLOPTYGMA. A. Adams. (233.)

Shell elongated, pupiform, turriculate, solid, smooth or slightly ribbed, polished; whorls inflated middle of spire, numerous; apex sinistral; aperture *sub-quadrangular*. *Dist.*—Europe, Japan, Australasia.

(XXXII.) Family LITTORINIDÆ.

(Shell spiral, *turbinate or globular;* peritreme entire; interior *not nacreous;* operculum corneous, spiral or or pauci-spiral.)

Genus LITTORINA. Ferussac. (234-238.)

Shell turbinated, thick, pointed, few whorled; aperture rounded; outer lip acute; columella rather flattened, imperforate, operculum, pauci-spiral. *Dist.*—Universal on sea shores.

Genus RISELLA. Gray. (239-241.)

Shell depressed, trochiform, with flattened whorls and keeled periphery; not umbilicated; aperture rhomboidal; marked with brown inside the margin; operculum pauci-spiral, distinguished from Trochus, which they resemble, by their non-nacreous interior. *Dist.*—Australasia, sea shore.

Genus FOSSARUS. Philippi. (242-244.)

Shell minute, turbinate, perforate, sculptured; inner lip thin; aperture semi-lunate; operculum not spiral. *Dist.*—Almost world-wide; among weed at low water.

(XXXIII.) Family PLANAXIDÆ.

Genus ALABA. H. and A. Adams. (245-247.)

Shell ovate, conical or elongated, *sub-diaphanous; whorls plicate or varicose;* apex sub-mammillate; aperture ovate, the columella more or less truncate. *Dist.*—Japan, West Indies, Australasia.

Sub-Genus DIALA. A. Adams.

Whorls *not varicose*, sometimes nodulate around the middle; columella *straightish*, *not truncated*; labrum not thickened. Dist.—Philippines, Japan, Australasia.

(XXXIV.) Family CERITHIIDÆ.

Shell spiral, elongated, many whorled, frequently varicose; *aperture channeled in front*, with a *less distinct* posterior canal; lip generally expanded in the adult; operculum, horny, spiral.

Genus CERITHIUM. Brug. (248-259.)

Shell turreted, many whorled, with indistinct varices; aperture small, *with a tortuous* canal in front; outer lip expanded; inner lip thickened; operculum horny, spiral. *Dist.*—Almost world-wide.

Sub-Genus BITTIUM.

Shell elevated, with numerous *granular* whorls and *irregular* varices; anterior canal short, *not recurved*; inner lip simple; outer lip *not reflected*; usually with an exterior rib; operculum four whorled.

Genus TRIFORIS. Deshayes. (260-261.)

Shell *sinistral*, sculptured, granular; whorls numerous, terminating below in a *small aperture with tubular anterior canal;* opposite this canal is sometimes a second one upon a varix, marking the position of a former aperture; operculum orbicular, few-whorled. *Dist.*—East Indies, Polynesia, Panama, West Indies, Mediterranean, Australasia.

Genus POTAMIDES. Brong. (262.)

Shell often large sized, *turriculated; whorls angulated and coronated;* aperture prolonged in front into a nearly straight canal; outer lip thin, *sinuous; epidermis thick*, olive brown; operculum many whorled. *Dist.*—Tropical and sub-tropical; fresh and brackish streams and swamps.

(XXXV.) Family RISSOELLIDÆ.

Genus TATEA. Tenison-Woods. (263.)

Shell minute, elongate, pyramidal, attenuate, with brownish-black epidermis; spire elevated, acuminate; whorls flattish (8); aperture pyriform; inner lip reflected; operculum horny and thin, with a vertical sub-marginal claw. *Dist.*—Only one representative, *T. Huonensis*, T. Woods. Found under stones at low water in tidal estuaries in Tasmania.

(XXXVI.) Family RISSOIDÆ.

Shell small, spiral, turreted or depressed, often more or less umbilicated; aperture more or less rounded, never truly channeled in front; peritreme continuous.

Sub-Family RISSOININÆ.

Shell small, ovate, or turreted with a thick corneous or calcareous pauci-spiral operculum, with internal process, *articulated (marine).*

Genus Rissoina. D'Orb. (264-274.)

Shell turreted, whorls numerous, *ribbed or cancellated;* aperture semi-lunar; lip slightly thickened within, somewhat expanded, faintly channeled anteriorly; operculum corneous, thick, semi-lunar, pauci-spiral *with an interior process. Dist.*—World-wide *(marine).*

Sub-Family Rissoinæ.

Shell small, ovate or elongate; operculum pauci-spiral, *not provided with an internal process (marine).*

Genus Rissoa. Frem. (275-289.)

Shell minute, white or horny, conical, pointed, many whorled; smooth, ribbed or cancellated; aperture rounded; peristome entire or continuous; *outer lip slightly expanded and thickened;* operculum sub-spiral. *Dist.*—Universal *(marine).*

Sub-Genus Setia. H. and A. Adams.

Shell thin, oval-oblong, or sub-conic; whorls few, ventricose spotted; spire short; apex obtuse; aperture sub-orbicular.

Sub-Genus Ceratia. H. and A. Adams.

Shell *sub-cylindrical, spirally striated,* white, thin, *sub-pellucid;* whorls rounded; summit of spire obtuse; aperture sub-oval; peristome continuous; *the outer lip thin and sharp.*

Sub-Genus Cingula. Fleming.

Shell thin, *elongated,* smooth or spirally striate, *spotted or banded;* aperture *pyriform or oval;* outer lip *sharp, with an external varix.*

Sub-Genus Alvania. Risso.

Shell *oval, turbiniform;* spire *rounded, usually cancellated;* aperture *sub-circular; crenulated within;* outer lip with a marginal exterior varix.

Sub-Family Hydrobiinæ.

Shell *very small,* or of moderate size, never exceeding two-fifths of an inch in length, globose, ovate or *elongated,* generally *umbilicated or rimate,* and *covered with a periostraca, for the most part of an olive colour*; whorls numerous (4-8) smooth or rarely ribbed or carinated; *never cancellated*; aperture more or less ovate or rounded, rarely sub-acute or effuse anteriorly; *peritreme continuous*; outer lip *usually simple and acute;* operculum pauci-spiral, corneous. *Dist.—Lakes, rivers* and *lagoons,* sea-level to 4,000 altitude; *mostly inhabiting fresh water* but some entering brackish water; herbivorous.

Genus HYDROBIA. Hartmann. (290-293.)

Shell minute, ovate or elongated, smooth, *sub-perforate*; spire conic; whorls generally flat; apex acute; aperture ovate; inner lip *not thickened*; operculum corneous; rostrum rather long; tentacles somewhat tapering but blunt at the extremity; foot somewhat pointed behind. *Dist.*—World-wide *fresh and brackish waters.*

Genus BITHYNELLA.? Moquin-Tandon. (294-303.)

Shell minute, elongated-ovate, usually somewhat pupiform, imperforate, or simply rimate; apex obtuse; aperture oval or rounded; peritreme continuous; outer lip sharp or slightly thickened; operculum corneous, nucleus moderately large, not very close to basal margin. Tentacles tapering blunt at the tip; foot rather narrow, rounded behind; very bifid. *Fresh water*, ascending to 4,000 feet altitude in Tasmania. *Dist.*—Europe, America, Australasia?

Genus POTAMOPYRGUS. Stimpson.

Shell ovate-conic, imperforate; apex acute; whorls coronated with spines: aperture ovate; outer lip acute; operculum corneous; rostrum moderate; tentacles very long, slender, tapering, and pointed; eyes on very prominent tubercles; foot rather short, broadest in front, and strongly auriculated. *Dist.*—Fresh water, New Zealand, Tasmania, Cuba.

Genus POTAMOPYRGUS.? Hutton *non* Stimpson. (294-303.)

Shell ovate-conic or oval, imperforate; body whorl more than half the length of shell; aperture ovate, the outer lip acute; peritreme continuous or discontinuous; operculum horny, sub-spiral, without any internal process. *Animal* with the foot rather short, broadest, and slightly expanded in front; tentacles very long, slender, tapering and pointed; eyes on very prominent tubercles. *Dentition*, median tooth trapezoidal; inferior margin more or less trilobate; first lateral broad and excavated in the middle, contracted into a long peduncle, the denticles nearly equal; second lateral pointed at the inner extremity; the shank broad and thickened on its outer margin; third lateral with the inner extremity broad and rounded, constructed at its junction with the very broad shank which is thickened on its outer margin. Number of transverse rows of teeth, 55 to 69. Formula of the denticles $\frac{7 \text{ or } 9}{3 \text{ or } 4 - 3 \text{ or } 4}$; 9 or 11; 20 to 23; 30 to 40. Hutton's new definition of *Potamopyrgus* would exactly

fit the numerous species in Australia, Tasmania, and New Zealand, hitherto variously assigned to *Paludestrina*, *Amnicola*, and latterly *Bithynella*. It is doubtful, however, whether the greatly modified definition may not have the effect of severing some of the original forms embraced under Stimpson's original definition of Potamopyrgus. A new name, say *Huttonia*, for the Australian, Tasmanian, and New Zealand forms, with the definition given by Professor Hutton, is suggested as the best course to adopt in the classification of Australasian species determined by the dentition characteristics.

Genus Brazieria. Petterd. 1888. (304.)

Shell minute, globosely rounded, *solid*, *imperforate;* spire small; body whorl large; *aperture very oblique;* outer lip acute; inner lip thickened; operculum horny, sub-spiral. Animal very similar to *Beddomeia Launcestonensis*, Johnston. *Dist.*—Fresh water streams, North-Western Tasmania—River Wye, Surrey Hills, and tributaries of the Arthur River. The shell originally described by Tenison-Woods as *Ampullaria Tasmanica*, and later transferred to genus *Amnicola*, is here provisionally referred to Petterd's new genus, *Brazieria*.

Sub-Genus Beddomeia. Petterd. 1888. (305-310.)

Shell globosely conical, thin, umbilicate or sub-umbilicate; spire short; body whorl inflated; aperture ovate; columella margin more or less thickened; operculum horny, pauci-spiral. Animal with a somewhat broad foot; *tentacles* long, *slender and pointed*; eyes sessile at outer base of same; muzzle broad and projecting. Dentition as in *Potamopyrgus*, Hutton *non* Stimpson, but the trapezoidal median tooth has quite a different arrangement of the inferior basal row, which consists of two ovate elevations on either side of a curved central tooth.

Formula of denticles on median tooth = $\frac{7 \text{ or } 9}{2-1-2.}$

Formerly the writer doubted the wisdom of erecting a new genus for the forms now included as above; but if the difficulty of the alteration of Stimpson's genus Potamopyrgus be surmounted, or if the name *Huttonia*, as suggested, be adopted for Professor Hutton's new definition as applied to Australasian forms, there is little doubt but that the sub-genus erected by Mr. Petterd would be most fitting for Australasian forms of this group.

Sub-Family Pomatiopsinæ.

(Shell and operculum as in Rissoinæ. Foot with lateral sinus. Amphibious.)

Genus Pomatiopsis. Tryon. (311-312.)

Shell elongated, frequently decollated, perforate, smooth; *whorls very convex*; aperture round; peristome continuous, slightly expanded or reflected. *Air breathing animal, preferring damp location in the vicinity of streams or lagoons.* *Dist.*—United States, Central America, Australia, Tasmania, Flinders' Island.

(xxxvii.) Family Assiminiidæ.

Genus Assiminea. Leach. (313.)

Shell small, oval, conical, with moderate spire; aperture rounded, oval, with sharp lip entire; columella lip somewhat thickened. *Dist.*—Europe, Asia, America, Tasmania.

(xxxviii.) Family Valvatidæ.

Genus Valvata. Müeller. (313ª.)

Shell depressed, conical (in the typical group), umbilicated; covered by a thin greenish epidermis; operculum orbicular, corneous, multispiral. Animal with a produced muzzle; tentacles long and slender, eyes at their bases; foot bilobed in front; branchial plume long, pectinated, partly exerted on the right side when the animal is walking; lingual teeth broad, uncini 3 lanceolate; all toothed and denticulated. *Dist.*—Freshwater, mundane.

(xxxix.) Family Truncatellidæ.

Genus Truncatella. Risso. (314-317.)

Shell small, sub-cylindrical or turbinate, with elevated spire; apex obtuse or truncated; whorls striated transversely; aperture oval, entire; peristome continuous; operculum corneous, sub-spiral. Animal with short diverging tentacles; eyes centrally behind; head bilobed; foot short, rounded at each end. *Dist.*—On stones and seaweed *between tide marks.*

(xl.) Family Neritidæ.

Genus Nerita. Linn. (318.)

Shell *thick*, smooth or spirally grooved; epidermis horny; outer lip thickened and sometimes *denticulated within;* columella broad and flat, with its inner edge *straight and toothed;* operculum shelly. *Dist.*—Nearly all warm seas, living on rocks and stones at low water.

(xli.) Family Liotiidæ.

(Shell *depressed*, spiral, white ribbed, *sometimes cancellate*, or nodulous; aperture orbicular, rarely pearly within; operculum *corneous inside*; outside with a calcareous coat of pearl-like shelly particles, spirally arranged.

Genus Liotia. Gray. (319-324.)

Shell turbinated or *depressed*, *varicose*, perforated or umbilicated whorls *ribbed or cancellated*; aperture rounded, *pearly within*; peristome thick, callously margined. *Dist.*—Tropical and sub-tropical.

Genus Cylostrema. Marryat. (325-333.)

Shell orbicular, depressed, *widely umbilicated, spire short*; whorls transversely *striated or cancellated*; aperture round, *not nacreous*; peristome continuous, simple. *Dist.*—Japan, Philippines, West Indies, Australasia.

(xlii.) Family Rotellidæ.

Genus Rotella. Lam. (334.)

Shell depressed, lenticular, the spire depressed, conical; aperture semi-orbicular; outer lip sharp; base with a convex rounded umbilical callus. *Dist.*—India, China, Japan, Philippines, Australasia.

(xliii.) Family Phasianellidæ.

Genus Phasianella. Lam. (335-339.)

Shell elongated, polished, richly coloured; *whorls convex*; aperture oval, *not pearly*; inner *lip callous, outer thin*; operculum shelly, callous outside, sub-spiral inside. *(Pheasant-shell.)* *Dist.*—Large species, Australasia; small species, India, Philippines; very small species, West Indies, Mediterranean, Great Britain.

(xliv.) Family Turbinidæ.

Genus Turbo. Linn. (340-342.)

Shell spiral, turbinated, solid, *nacreous inside*; whorls convex, smooth, grooved or tuberculated; aperture *large, rounded*, slightly produced in front; operculum *shelly and solid*, callous outside and smooth, or variously grooved and mamillated, internally horny and pauci-spiral. *Dist.*—World-wide; rocks and weeds at low water, along the shore. (*Top-shell.*)

Sub-Genus TURBO. (Restricted.)

Shell smooth, or tuberculate, covered by a smooth epidermis; inner lip flattened, more or less produced in front; *no umbilicus*, operculum spiral on its inner face, convex and smooth or granular (*not ridged*) externally.

Sub-Genus SENECTUS. Humph.

Shell solid, with revolving squamose or spinose ridges covering the whorls; axis usually *narrowly perforated;* aperture usually slightly produced in front, with sometimes a short channel.

Sub-Genus MARMOROSTOMA. Swains.

Shell thick, smooth or tuberculate; aperture rounded in front; columella callus covering the axis, *which is umbilicated*, however; the umbilicus often *at the upper end of a curved channel in the callus;* operculum spiral, with central nucleus, and an indistinct sub-central external rib.

(xlv.) Family TROCHIDÆ.

(Shell usually conical, with *flattened base, nacreous inside;* operculum *corneous*, multispiral.)

Genus TROCHUS. Linn. (343-388.)

Shell pyramidal, with nearly a flat base; whorls, numerous, flat, variously striated; aperture oblique, rhombic, pearly inside; columella twisted, slightly truncated; outer lip thin; operculum, horny, multispiral. *Dist.*—World-wide; low water to 15 fathoms, the smaller species to 100 fathoms.

Sub-Genus TROCHUS. (Restricted.)

Umbilical region *excavated but not perforated;* columella *spirally twisted above*, terminating *in a point anteriorly.*

Sub-Genus INFUNDIBULUM. Mont. (CARINIDEA. Swains.)

Shell, conical; whorls *flattened, the last angular, base concave;* columella *without teeth*, or teeth obsolete.

Sub-Genus MINOLIA. A. Adams.

Shell globosely *conoidal*, widely and *profoundly umbilicated;* whorls rounded, clathrate; suture canaliculate; last whorl, subsolute towards the aperture; umbilicus perspective; aperture circular, pearly within; *peristome*, continuous, thin, acute.

Sub-Genus ASTELE. Swainson. (Tas. Journal, 1855.)

Shell nacreous, *pyramidal* or trochiform; unarmed; body whorl convex; columella, none; *umbilicus large*, closed only by the terminal whorl of the spire; aperture, broader than high, the margin of both lips thin.

Sub-Genus MONILEA. Swainson.

Shell *orbicular, depressed, widely umbilicated ;* whorls encircled by grooves, the last rounded ; umbilicus *encircled by a striated callus ;* columella terminating anteriorly in one or two tubercles.

Sub-Genus GIBBULA.

Shell *conoidal, umbilicated ; umbilicus cylindrical or infundibuliform ;* whorls frequently tuberculated above, and with channeled suture ; columella *sometimes* terminating in a tubercular tooth.

Sub-Class ZIZYPHINUS. Gray. (CALLIOSTOMA.) Swains.

Shell trochiform, conical, *not umbilicated ;* last whorl *angulated* and usually *ribbed at the periphery ;* aperture, *quadrangular ;* columella simple, oblique, often ending in a tooth in front.

Sub-Genus THALOTIA. Gray.

Shell ovate-turriculated, rather thick, *not umbilicated ;* whorls *flattened*, with revolving *ribs, which are sometimes granular ;* aperture, sub-rotund ; columella *tuberculate, truncate in front ;* outer lip *rather thick, crenulated within.*

Sub-Genus ELENCHUS. Humphrey.

Shell elevated, conoidal, *spire sharp ;* whorls *rather flat, smooth, polished,* usually *with distant revolving incised lines ;* aperture *sub-oval ;* columella with *a tooth-like projection in the middle ;* outer lip thickened within. Brilliantly coloured shells, but very pearly within (used as ornamental necklaces by the Tasmanian Aborigines).

Sub-Genus CANTHARIDUS. Montfort.

Shell ovate, thin, outer lip acute ; the columella wants the conspicuous tooth seen in *Elenchus ;* the whorls are *encircled by striæ and not polished ;* interior highly iridescent.

Sub-Genus BANKIVIA. Beck.

Shell *subulate*, with sharp spire, polished, bright coloured ; whorls smooth, flattened, *without epidermis ;* aperture sub-ovate, rather large, *not nacreous within ;* columella twisted, truncated in front ; outer lip simple, sharp.

Sub-Genus TROCHOCOCHLEA. Klein.

Shell elevated, turbiniform ; whorls bluntly angled at the periphery, or with revolving carinæ ; outer lip thin, smooth within ; inner lip *spreading, twisted, dentate below, no umbilicus.*

Sub-Genus Euchelus. Phil.

Shell *conoidal, turbinate umbilicated*; whorls rounded, with *granulated* revolving ribs; columella lamellarly produced into a central tooth; outer lip thickened and *crenulate within*; opercular whorls rather few, rapidly increasing.

Sub-Genus Clanculus. Montfort.

Shell conoidal or turbinated, *not umbilicated*; whorls mostly *granulous*; aperture contracted; columella spirally twisted, forming a *false umbilicus, plicated throughout* and terminating in a *multi-dentate varix*; outer lip *dentate within*, with sometimes a larger superior tooth.

Sub-Genus Diloma. Philippi.

Shell *conoidal, smooth, not umbilicated*; whorls rather few, *convex*; aperture sub-rotund; columella lip *excavated in the middle and expanded over the umbilicus region*, produced laterally to join the outer lip; outer lip thin, unarmed.

Genus Margarita. Leach. (—)

Shell *thin, globular, conical, umbilicated*; whorls rounded, smooth; aperture rounded, pearly; lip sharp, smooth. *Dist.*—Japan, California, Australasia.

(xlvi.) Family Stomatellidæ.

Genus Stomatella Lam. (389.)

Shell *ear-shaped*, regular; spire small; aperture oblong, very large and oblique, *nacreous*; lip thin, even edged; operculum circular, *horny*, multispiral. *Dist.*—On reefs and under stones at low water.

Genus Stomatia. Helbing. (390.)

Shell like *Haliotis, but without perforations*, their place being occupied by a *simple furrow*; surface rugose, smooth or spirally ridged; spire small, prominent; aperture *large, oblong;* outer magin irregular. *Dist.*—Java, Philippines, Torres Straits, Pacific, Australasia.

Sub-Genus Gena. Gray.

Shell sub-spiral, *oblong, auriform, depressed*, smooth or striated; *spire flattened, nearly obsolete*; aperture very large; no operculum.

(xlvii.) Family Pleurotomariidæ.

Shell more or less conically elevated, turreted or trochiform, *with a marginal slit* in the upper part of the outer lip, or a row of perforations in the upper part of the whorl; aperture often pearly within.

Genus SCHISMOPE. Jeffreys. (391.)

Shell minute, thin, translucent, *not pearly*; spire laterally compressed, as in Stomatia; *slit* of the young shell is *converted into a foramen* in the adult; it does not commence until the animal is half grown. *Dist.*—Mediterranean, Japan, Tasmania.

(xlviii.) Family HALIOTIDÆ.

Genus HALIOTIS. Linn. (392-395.)

Shell *ear-shaped*, large, with a small flat spire; aperture very wide, *iridescent*; exterior striated, dull; outer angle *perforated by a series of holes*, those of the spire progressively closed. *Dist.*—Almost world-wide.

(xlix.) Family FISSURELLIDÆ.

Shell conical, *limpet-shaped*; apex recurved; nucleus spiral, *often disappearing* in the course of growth; anterior margin *notched* or apex *perforated*; muscular impression horse-shoe shaped, open in front.

Genus FISSURELLA. Lam. (396-401.)

Shell oval, *conical*, *depressed*, with the apex in front of the centre, *and perforated*; surface radiated or cancellated; muscular impression with the points incurved. *Dist.*—Universal, but mostly in warm seas.

Sub-Genus MACROSCHISMA. Swainson.

Shell *square*, *oval*, *roughly rayed*, truncate at the end; perforation *very large*, *sub-triangular*, elongated.

Genus EMARGINULA. Lam. (402-405.)

Shell oval, conical, *elevated*, *with the apex recurved*; surface *cancellated*; *anterior margin notched*; muscular impression with recurved points. *Dist.*—Almost world-wide, range low-water to 90 fathoms.

Genus PARMOPHORUS. Blainv. (406-408.)

Shell *lengthened oblong depressed*; apex posterior; front margin incurved; muscular impression horse-shoe shaped, elongated; shell smooth, white. *Dist.*—East Indies, Philippines, Australasia.

(l.) Family PATELLIDÆ.

Shell *wholly external*, disc shaped, with apex anteriorly directed. (*Limpets.*)

Genus ACMÆA. Esch. (409-417.)

Shell solid, limpet form; *apex erect*, or anteriorly inclined. *Dist.*—Mostly West Coast of North America, Europe, Australasia.

Genus PATELLA. (418-424.)

Shell conical, *more or less depressed*, oval at the base; apex sub-central or anterior, from which usually radiate ribs, which are are frequently nodose; mostly crenulated on the inner margin. *Dist.*—World-wide. (Common Limpet.)

(li.) Family CHITONIDÆ.

Shell composed of *eight separate transverse imbricating plates*, lodged in a coriaceous mantle, which forms an expanded margin around them.

Genus CHITON. Linn. (425-433.)

Same general description as given for the family.

Sub-Genus CHITON. Lam.

Girdle covered with distinct scales; anterior and posterior valve with many slits, middle valve with one.

Sub-Genus LOPHYRUS. Poli. (RADSIA. Gray.)

Teeth in *middle valve two or more*; differs also from Chiton in having side slits.

Sub-Genus LEPIDOPLEURUS. Risso. (Isnochiton.)

Scales transverse, flattened, somewhat imbricated, generally striated.

Sub-Genus PLAXIPHORA. Gray. (EUPLACIFORA. Gray.)

Mantle with a double series of pores, beset with bifurcate bristles, one row at the insertion of the valves, the other at the external margin; shell with the valves broad, transverse, external.

Sub-Genus ACANTHOCITES. Risso.

Mantle densely spinulose, surrounded with a series of setigerous pores; shell with the valves deeply immersed, sub-equal externally, the exposed part moderate; cordate as broad as long; plate of insertion of the anterior valve six lobed, that of the middle bi-lobed, that of the posterior five lobed,

Genus CHITONELLUS. Blainville. (434-435.)

Tail plate funnel shaped; laminæ thrown forward; insertion plates very sagittate; slits in anterior valve 5, in middle 0-1, in posterior none; teeth very short, except of sutures; eaves distinct; sinus very deep and narrow; girdle crowded with bristles, no tufts; gills posterior.

Sub-Genus CRYPTOPLAX. Gray.

Middle valve without ribs; girdle with crowded bristles, tufted.

(lii.) Family Philinidæ.

Genus Philine. Ascanias. (436.)

Shell *bulliform, not forming a single whorl,* internal, white, translucent, oval, slightly convoluted; spire rudimentary *Dist.*—West Indies, Boreal Atlantic, Mediterranean, East Indies, Australasia.

(liii.) Family Tornatellidæ.

Shell *spiral, ovate, convolute* or involute, spire more or less elevated; surface mostly *spirally punctated*; aperture usually high and narrow, truncate or roundish in front; columella solid.

Genus Tornatina. D'Orb. (437.)

Shell oval, elongated, conical or fusiform, with revolving punctated striæ; aperture long and narrow, widened in front, entire; lip sharp; columella thickened, but without plications. *Dist.*—Almost world-wide.

Genus Ringicula. Desh. (438.)

Shell *minute,* ventricose, with small spire; aperture *notched*; columella callous, *deeply plaited*; outer lip *thickened and reflected. Dist.*—In all warm seas.

(liv.) Family Cylichnidæ.

Shell external, spiral, *more or less cylindrical*; nearly white; no operculum.

Genus Cylichna. Lorén. (439-440.)

Shell strong, *cylindrical,* smooth, or punctate-striate; spire minute or truncated; aperture narrow, rounded in front; columella callous, with one plait. *Dist.*—Chiefly deep water shells, Greenland, Britain, Red Sea, Australasia.

(lv.) Family Bullidæ.

Shell spiral, *ventricose, rather thick, maculated* and *banded* in the typical genus, white in others; spire *involute*, external, but usually partly covered by the lateral lobes of the foot.

Genus Bulla. Linn. (441.)

Shell oval, globular, smooth, spotted, marbled or zoned; spire concave; aperture as long as the shell; inner margin without columella; outer lip trenchant. *Dist.*—Universal.

Genus HAMINEA. Linn. (442)

Shell oval, globular, spiral, ventricose, *corneous*, thin, covered by a slight *smooth epidermis*; spire involute; lacks the colours of Bulla.

(lvi.) Family LOPHOCERIDÆ.

Genus AKERA. Muller. (443.)

Shell like Bulla, thin, flexible, globosely cylindrical; spire truncated; whorls channeled; aperture long, expanded and deeply sinuated in front; outer margin disunited at the suture; columella open, exposing the whorls. *Dist.*—Greenland, Great Britain, Mediterranean, East Indies, Australasia.

(lvii.) Family APLYSIIDÆ.

Shell wanting or rudimentary, and covered by the mantle; *oblong, trigonal or slightly convoluted*; large, slug-like animals.

Genus APLYSIA. Gmelin. (444-445.)

Shell oblong, convex, *flexible and translucent*, with a posterior slightly incurved apex. (Sea-hare.) *Dist.*—West Indies, Norway, Britain, Mediterranean, Mauritius, China, Australasia.

(lviii.) Family VITRINIDÆ. (Land Shells.)

Shell usually thin, corneous, transparent, spiral, of *few rapidly enlarging whorls*.

Genus VITRINA. Drap. (446-448.)

Shell imperforate, very thin, depressed; spire short, last whorl large; aperture large, lunate or rounded; columella margin slightly inflected; peristome often membranous. *Dist.*—Universal, mostly inhabit cold or temperate countries or mountain regions of warm countries.

(lix.) Family HELICIDÆ. (Land Shells.)

(Shell spiral, usually thicker than in the Zonitidæ, and mostly with reflected lip, the aperture edentulous or contracted by teeth.)

Genus HELIX. (449-518.)

Shell of variable form, smooth, rugose, striate, ribbed or tuberculate, sometimes pilose; orbicular convex, planorbid, trochiform subturriculated, or short bulimiform (monstrosities sinistral, or with the whorls more or less uncoiled); aperture oblique, oval or

semi-lunar, with or without interior teeth on the margin or parietal wall; lip simple or thickened internally or reflected, umbilicus covered, widely open. *Dist.*—Universal.

Genus BULIMUS. (519-520.) Land Shells.

Shell *oval-oblong* or *turriculated*, solid, sub-perforate or imperforate; whorls few, the last ventricose and large; aperture longitudinal; columella widened, rarely plicate; peristome thickened, reflected; the lip usually joined by a callus. *Dist.*—Mostly South American.

(lx.) Family PUPIDÆ. (Land Shells.)

Shell generally *minute*, multispiral, cylindrical, with obtuse summit (pupiform); *aperture small*, usually contracted by internal teeth or lamellæ.

Genus PUPA. (521.)

Shell usually *very small, cylindrical or oval*-oblong; umbilicus slight or a mere slit; plicate, striate or costellate brown or horn-colour; columella *plicate or sub-dentate; lip reflected*, usually dentate or plicate within, the extremities usually joined by a raised callus. *Dist.*—Universal, boreal and tropical.

(lxi.) Family LIMACIDÆ. (Terrestrial Land Slugs.)

Shell *rudimentary, a calcareous plate, not spiral*, concealed under the mantle, and covering the respiratory cavity.

Genus LIMAX. (522.)

Shell-plate *testaceous thin, flat*, longer than wide, with concentric striæ of increase, internal. *Dist.*—Universally distributed.

(lxii.) Family ARIONIDÆ.

(*Animal naked*, with or without mucous pore; mantle concealing a shell-plate, or a few calcareous grains which represent it; jaw strongly ribbed; central tooth tricuspidate, the median cusp long and narrow; laterals and marginals bicuspidate.)

Genus CYSTOPELTA. (523.)

Body attached for half its length to the back of the foot; mantle very large, enveloping the whole animal in repose, but from beneath which the head and the tip of the tail alone are visible from above when the animal is crawling; tentacles four; tail with a mucous spore at the tip; mandible like that of Arion; lingual teeth resembling those of Testacella. No shell. *Dist.*—Tate. Tasmania.

(lxiii.) Family Succineidæ.

Genus Succinea. (524-525.)

Shell oval, very fragile and transparent; spire short; the whorls few, and very rapidly enlarging; aperture oval; outer lip thin, not reflected, united below by a very broad curve with the thin, smooth columella. *Dist.*—World-wide; sub-aquatic, living in damp places, near the margin of streams.

(lxiv.) Family Auriculidæ.

(Shell oblong-oval, covered by a thin epidermis; spire short, conoidal, very rarely sub-elongated; last whorl large; rounded at the base; aperture longitudinal, narrow, ear-shaped; inner wall of the aperture with two or three plications, peristome thickened internally, without teeth.)

Genus Cassidula. (526-529.)

Shell sub-perforated, cassidiform, solid; spire short, conoidal; last whorl very large, attenuated to the base, where it is usually carinated or angulated around the axis; aperture narrow, sinuous; inner lip dentately plicate; columella plication strong; outer lip thickened within by a strong callosity with toothed edge. *Dist.*—Ceylon, East Indies, Philippines, Australasia, Polynesia.

Genus Alexia. (527.)

Shell oblong-oval, thin, spire acuminate; last whorl large, rounded at base; columella with an oblique plait; aperture contracted by teeth, and sometimes by a callosity of the outer lip. *Dist.*—United States, West Indies, Maderia, Europe.

Genus Marinula. (528.)

Shell oval-oblong, imperforate, solid, smooth; spire short, sharp; aperture oval; inner lip rather thick, excavated with three plications, the posterior largest; outer lip simple, sharp. *Dist* —Australia, Mediterranean, W. Coast of America.

Genus Ophicardelus. (529.)

Shell oval-oblong, umbilicated, smooth; spire elevated-conic; aperture oval, elongated, angulated above; inner lip reflected, with two spiral plications, one of which surrounds the umbilicus; outer lip thin, simple. *Dist.*—Australia, Polynesia.

(lxv.) Family Limnæidæ.

Shell thin, horn-coloured, mostly spiral, sometimes patelliform, capable of containing the entire animal, contracted; aperture simple, rounded; lip sharp.

Genus Limnæa. (530-533.)

Shell normally dextral, oval-oblong, thin, corneous, translucid; spire sharp, more or less acuminated; last whorl ventricose; aperture oval, ample, rounded in front; columella lip with an oblique plait entering above. *Dist.*—Europe, Asia, America, North of the Equator, Polynesia.

Genus Amphipeplea. (534-535.)

Shell globular, ventricose, thin, transparent; spire very short, depressed; aperture very large; columella without fold; outer lip sharp. *Dist.*—Europe, East Indies, Australia, Philippines.

Genus Physa. (536-547.)

Shell ovate, sinistrally spiral, thin, polished; aperture rounded in front. *Dist.*—North America, Europe, East Indies.

Genus Planorbis. (548-551.)

Shell discoidal, biconcave, the whorls visible on both sides; aperture small, rounded, margin usually simple, sometimes expanded. *Dist.*—World-wide.

Genus Ancylus. (552-554.)

Shell conical, limpet-shaped, thin; apex posterior turned to the left; aperture with entire basal margin; interior with a sub-spiral muscular scar. *Dist.*—North and South America, Europe, Australia.

Genus Gundlachia. (555-556.)

Shell very small, thin, obliquely conic, apex inclined posteriorly and to the right; base two-thirds closed by a flat, straight-edged shelf, leaving a semicircular aperture. *Dist.*—United States, Cuba, Tasmania.

(lxvi.) Family Amphibolidæ.

Genus Amphibola. (557-559.)

Shell sub-globose, rather thick, rugose, umbilicated; spire short, whorls shouldered above, umbilicated; aperture sub-oval; columella lip callous; columella flattened and reflected; outer lip sinuous posteriorly; operculum corneous, sub-spiral. *Dist.*—New Zealand.

(lxvii.) Family SIPHONARIIDÆ.

Genus SIPHONARIA. (560-562.)

Shell solid, porcellanous; apex central or sub-central; provided with more or less elevated radiating ribs or ridges, which by their projection render the margin irregular. *Dist.*—Cape, India, Philippines, Australia, New Zealand, Pacific, Galapagos, Peru, Cape Horn, West Indies, West Coast of North America.

CLASS SCAPHOPODA.

(lxviii.) Family DENTALIIDÆ.

Genus DENTALIUM. (563-564.)

Shell *tube-like*, gradually tapering posteriorly, longtitudinally ribbed, margin of the aperture sharpened, posterior end with an internal, slightly projecting tube, which is provided with a dorso-ventrally elongated opening; the outer layer having a very slight emargination dorsally and ventrally. *Dist.*—Universal.

CLASS PELECYPODA.

(*Lamellibranchiata. Conchifera.*)

(lxix.) Family GASTROCHÆNIDÆ.

Shell *equivalve*, gaping; valves *thin*, edentulous, united by a thin external ligament, sometimes *cemented to a shelly tube* when adult; adductor impressions 2, pallial line *sinuated*.

Genus ASPERGILLUM. (565.)

Shell small, equilateral, *cemented to the lower* end of a *shelly tube, the umbones alone visible* externally; tube elongated, closed below by a perforated disc, with a minute central fissure; siphonal end plain, or ornamented with ruffles. *Dist.*—Red Sea, Java, Australia, New Zealand; in sand.

Genus GASTROCHÆNA. (566.)

Shell *elongated, narrow*, contained within *a shelly tube*; posterior adductor nearly central, with a pedal star in front; siphonal inflection angular, with its apex joining the pallial line; tube round, straight, tapering upwards, transversely striated, closed at the lower end when complete, and furnished with a perforated diaphragm behind the valves. *Dist.*—Madagascar, India, Philippines, Australia; burrowing in sand or mud.

(lxx.) Family Teredidæ.

Genus Teredo. (567.)

Shell *globular*, open in front and behind, lodged at the inner extremity of *a burrow partly or entirely lined with shell*; valves *three lobed*, concentrically striated, and with one transverse furrow; hinge margins reflected in front, marked by the anterior muscular impressions; umbonal cavity with a long, curved, muscular process. *Dist.*—Norway, Britain, Black Sea, Tropics, Australasia. 119 fathoms.

(lxxi.) Family Pholadidæ.

Genus Barnea. (568.)

Shell *oval*, oblong, anteriorly gaping; with *a single* lanceolate *dorsal accessory valve*; umbonal process reflected, closely applied. *Dist.*—Australia, Burmah, Red Sea, Europe, Patagonia, Philippines.

(lxxii.) Family Solenidæ.

Genus Solen. (569.)

Shell *very long*, *sub-cylindrical*, *straight*, margins parallel, ends gaping; beaks terminal, or sub-central; hinge teeth, one in each valve; ligament long, external; anterior muscular impression elongated; posterior oblong; pallial line extending beyond the adductors; sinus short and square. *Dist.*—World-wide, except Arctic Seas; 100 fathoms.

(lxxiii.) Family Saxicavidæ.

Shell equivalve, *thick*, *gaping at the extremities*; hinge with a single cardinal tooth; ligament external, prominent, solid, inserted in a nymphal callosity; pallial impression *irregular*, *sinuous*.

Genus Saxicava. (570.)

Shell when young symmetrical, with two minute teeth in each valve; adult rugose, toothless; oblong, equivalve gaping; ligament external; *pallial line sinuated, not continuous*. *Dist.*—Universal.

Genus Panopæa. (571.)

Shell equivalve, thick, oblong, gaping at each end, ligament external *on prominent ridges*; one prominent tooth in each valve; *pallial sinus deep*. *Dist.*—Northern Seas, Mediterranean, Cape, Australia, New Zealand, Patagonia; low water—90 fathoms.

(lxxiv.) Family Corbulidæ.

Shell *small*, inequivalve, thick, *gaping in front*; hinge consisting of a single recurved tooth in one valve, received into a fosset or notch in the other.

Genus Corbula. (572-573.)

Shell thick, *inequivalve*, *gibbose*, closed, produced posteriorly; right valve with a prominent tooth in front of the cartilage pit; left valve smaller, with a projecting cartilage process; pallial sinus slight; pedal scars distinct from the adductor impressions. *Dist.*—United States, Norway, Britain, Mediterranean.

Genus Neæra. (574.)

Shell *globular*, *attenuated*, and gaping behind; right valve a little the smallest; umbones strengthened internally by a rib on the posterior side; cartilage process spatulate in each valve (furnished with a movable ossicle—Deshayes), with an obsolete tooth in front, and a posterior lateral tooth; pallial sinus very shallow. *Dist.*—Norway, Britain, Mediterranean, Canaries, Madeira, China, Moluccas, New Guinea, Chili; from 12-200 fathoms.

(lxxv.) Family Anatinidæ.

Shell often inequivalve, *thin*, *interior nacreous*; surface granular; ligament external, thin; cartilage internal, placed in corresponding pits and usually furnished with a free ossicle; muscular impressions faint, the anterior elongated; pallial line usually sinuated.

Genus Anatina. (575-578.)

Shell *oblong*, *ventricose*, sub-equivalve, *thin and translucent*, posterior side attenuated and gaping; umbones fissured, directed backwards, supported internally by an oblique plate; hinge with a spoon-shaped cartilage process in each valve, furnished in front with a transverse ossicle; pallial sinus wide and shallow. *Dist.*—India, Philippines, New Zealand, Japan, United States.

Genus Myodora. (579-583.)

Shell *trigonal*, *rounded in front*, *attenuated and truncated behind*; right valve convex, left flat; interior pearly; cartilage narrow, triangular, between two tooth-like ridges in the left valve, with a free sickle-shaped ossicle; pallial line sinuated; structure like Anatina; outer cells large, rather prismatic. *Dist.*—New Zealand, New South Wales, Philippines.

Genus Myochama. (584-585.)

Shell inequivalve, *attached by the dextral valve, and modified* by the form of the surface of attachment; posterior side *attenuated*; *left valve gibbose*; cartilage internal, between two tooth-like projections in each valve, and furnished with a movable ossicle; anterior muscular impression curved, posterior rounded, pallial sinus small. *Dist.*—Australasia; attached to Crassatella and Trigonia in 8 fathoms water; the fry, (as indicated by the umbones) is free, regular and Myodora-shaped.

(lxxvi.) Family Mactridæ.

Shell *equivalve, trigonal*, close or slightly gaping; ligament (cartilage) *internal*, sometimes external, contained in a *deep triangular pit; epidermis thick*; hinge with two diverging cardinal teeth, and usually with anterior and posterior laterals; pallial sinus short, rounded.

Genus Mactra. (586-588.)

Shell nearly *equilateral*; anterior hinge-tooth Λ shaped, with sometimes a small laminar tooth close to it; lateral tooth doubled in the right valve. *Dist.*—All seas, especially within the tropics; 35 fathoms.

Genus Lutraria. (589.)

Shell *oblong, gaping at both ends*; cartilage plate prominent, with 1 or 2 small teeth in front of it in each valve; pallial sinus deep, horizontal. *Dist.*—United States, Brazil, Britain, Mediterranean, Senegal, Cape, India, New Zealand, Sitka.

(lxxvii.) Family Paphiidæ.

Genus Pahia. (590-595.)

Shell *trigonal, thick, compressed*, closed; ligament *internal, in a deep, central pit*; a minute interior hinge-tooth, and 1—1 lateral teeth in each valve; muscular scars deep; pallial sinus small. *Dist.*—West Indies, Mediterranean, Crimea, India, New Zealand, Tasmania, Chili; sands at low-water.

Sub-Genus Mesodesma. Desh.

Shell *oval, sub-equilateral*; lateral teeth short, smooth, sub-equal; siphonal inflection distinct.

Sub-Genus Donacilla. Lam.

Shell *elongate, cuneiform*, slightly *truncate posteriorly*; anterior lateral teeth *elongated*; posterior short; siphonal sinus distinct.

Sub-Genus ANAPA. Gray.

Shell *sub-trigonal, ventricose,* truncate posteriorly; lateral teeth sub-equal, compressed, smooth; siphonal inflection *obsolete.*

(lxxviii.) Family SEMELIDÆ.

Genus SEMELE. (596-598.)

Shell *rounded, sub-equilateral, beaks turned forward*; posterior side *slightly folded*; hinge-teeth 2·2, laterals elongated, distinct in the right valve; external ligament short, cartilage internal, long, oblique; pallial sinus *deep, rounded. Dist.*—West Indies, Brazil, India, China, Australasia, Peru.

(lxxix.) Family TELLINIDÆ.

Shell *free, compressed,* usually closed and equivalve; cardinal teeth, 2 at most, laterals 1—1, sometimes obsolete; muscular impressions rounded, polished; pallial sinus very large; ligament on shortest side of the shell; external structure obscurely prismatic-cellular; prisms fusiform, nearly parallel with surface, radiating from the hinge in the outer layer, transverse in the inner.

Genus TELLINA. (599-606.)

Shell slightly *inequivalve, compressed,* rounded in front, angular and slightly folded posteriorly, umbones sub-central; teeth 2·2, laterals 1—1, most distinct in the right valve; pallial sinus very *wide and deep;* ligament external, prominent. *Dist.*—In all seas, especially the Indian Ocean. Most abundant and highly coloured in the Tropics. Low water—coral zone, fifty fathoms. Wellington Channel, Kara Sea, Behring's Straits, Baltic, Black Sea.

Genus GARI. (607-609.)

Shell transverse, *oval-oblong, flat,* equivalve, sub-equilateral, *concentrically plicate,* a little gaping on each side and covered by a *thin epidermis;* hinge narrow, with two small cardinal teeth, sometimes bifid, in each valve; beaks small; ligament long and prominent; margins simple; muscular impressions rather large, equally distant from the hinge, the anterior oblong, the posterior rounded; pallial impression distant from the margin, with a *narrow, profound* sinus. *Dist.*—Norway, Britain, India, New Zealand, Pacific; littoral—coralline zone, 100 fathoms. *G. Gari* is eaten in India.

Genus HIATULA. (610-611.)

Valves *oval-oblong, compressed*, ventral margin usually *incurved* posteriorly, where the valves are attenuated; broadly rounded anteriorly; beaks sub-median, not prominent, violaceous, under an olive epidermis; ligament thick, swollen; one or two very small cardinal teeth in each valve; muscular impressions rounded, distant; pallial impression *very sinuous*. *Dist.*—W. Indies, Red Sea, India, Madagascar, Japan, Australia, Tasmania, Peru.

(lxxx.) Family VENERIDÆ.

(Shell *regular, closed, sub-orbicular or oblong;* ligament external; hinge with usually three diverging teeth in each valve; muscular impression oval, polished; *pallial line sinuated.*)

Genus VENUS. (612-623.)

Shell thick, *ovate*, smooth, sulcated, or cancellated; margins minutely crenulated; cardinal teeth 3·3; pallial sinus *small, angular;* ligament prominent; lunule distinct. *Dist.*—World-wide. Low water, 140 fathoms. *V. Astartoides*, Behring's Sea. *V. Verrucosa*, Britain, Mediterranean, Senegal, Cape, Red Sea, Australia?

Sub-Genus CHIONE. Megerle. (MURCIA, Romer. OMPHALOCLATHRUM. Klein.)

Shell *oval, triangular* or *sub-cordiform; margins finely crenulated;* hinge narrow, solid, with *three teeth in the right* valve, *two in the left*, the anterior tooth longest; ligament narrow; pallial sinus *shallow*. Mantle-margins folded and dentate; siphons short, unequal, the branchial doubly cirrated, the anal ciliated.

Genus CYTHEREA. (624-631.)

Shell like Venus; oval-triangular, smooth; margins simple; hinge with *three cardinal teeth* and an *anterior tooth beneath the lunule; pallial sinus moderate, angular.* *Dist.*—Same as Venus. Recent. 150 sp.

Sub-Genus CALLISTA.

Shell oval, *transverse, inequilateral;* pallial sinus sub-oval, profound. Mantle-margins folded and cirrous above the siphons; siphons united, cirrated at their extremities.

Sub-Genus GOULDIA.

Shell *sub-trigonal, oval, shining, inflated.*

Genus Dosinia. (632-636.)

Shell *orbicular*, *compressed*, *concentrically striated*, pale, ligament sunk ; lunule deep ; hinge like Cytherea, margins even ; pallial sinus *deep*, *angular*, ascending. *Dist.*—Boreal, Tropical Seas. Low water, 80 fathoms.

Sub-Genus Gouldia.

Shell sub-trigonal, oval, smooth, shining, inflated.

Genus Tapes. (637.)

Shell *oblong*, umbones anterior, margins smooth ; teeth, three in each valve, *more or less bifid ;* pallial sinus *deep*, *rounded*. *Dist.*—Norway, Britain, Black Sea, Senegal, Brazil, India, China, New Zealand. Low water, 100 fathoms.

(lxxxi.) Family Cyrenidæ.

Shell *sub-orbicular*, closed, ligament external ; *epidermis thick*, *horny ;* umbones of aged shells eroded ; hinge with two or three cardinals and lateral teeth ; pallial line with a *small inflection*.

Genus Corbicula. (638.)

Shell sub-cordiform, solid, close, concentrically striated or rigid, covered by a smooth, greenish epidermis ; three cardinal teeth in each valve, the right anterior and left posterior rather small ; lateral teeth elongated, compressed, striated ; ligament prominent, thick ; pallial impression with a slight or well-marked sinus. *Dist.*—India, East Indies, Philippines, S. America.

Genus Pisidium. (639-640.)

Shell *sub-oval*, *trigonal*, inequilateral, covered by a greenish *epidermis ;* cardinal teeth very small, elongated, one sometimes bifurcated in the right valve, two diverging in the left valve ; lateral teeth longitudinal, compressed, lamelliform, double in the right valve. *Dist.*—Universal. *Fresh water lakes and rivers*, Tasmania.

Genus Sphærium. (41.)

Syn. Cyclas.

Shell thin, *oval or sub-orbicular*, inflated, covered by a *greenish epidermis ;* cardinal teeth very small or rudimentary, one more or less bifurcated, one in the right and two oblique ones in the left valve ; lateral teeth compressed, lamelliform, the anterior shortest ; ligament short ; margins plain, muscular impressions scarcely apparent, sub-marginal ; pallial impression simple. *Dist.*—Universal.

(lxxxii.) Family Petricolidæ.

Genus Rupellaria. (642-647.)

Shell *elongated*, moderately tumid, *surface rugosely striated* and *ribbed*, distinctly *gaping posteriorly*; hinge in the right valve with two cardinal teeth, and a third very small, but usually obsolete, anterior; the middle one is prominent, curved as in Petricola; the posterior is longitudinally lamellar, low and bifurcate; in the left valve are three distant and very unequal cardinal teeth; the middle one is similarly projecting as the corresponding tooth in the other valve. *Rup. lamellifera*, Conrad; may be considered as a type of a group. *Dist.*—Europe, Pacific, etc.

(lxxxiii.) Family Cardiidæ.

Genus Cardium. (648-651.)

Shell *ventricose*, close or gaping posteriorly; umbones *prominent*, sub-central; *radiately ribbed*; margins *crenulated*; pallial line more or less sinuated. *Dist.*—World-wide; from sea shore to 140 fathoms. Gregarious on sands and sandy mud.

(lxxxiv.) Family Chamidæ.

Genus Chama. (652.)

Shell attached *usually by the left umbo*; *valve foliaceous*, the *upper smallest*; hinge tooth of free valve thick, curved, received between two teeth in the other; adductor impressions large, oblong, the anterior encroaching on the hinge-tooth. *Dist.*—Tropical seas, especially amongst coal reefs: fifty fathoms. West Indies, Canaries, Mediterranean, India, China, Australasia.

(lxxxv.) Family Lucinidæ.

Shell *orbicular*, free, closed; hinge-teeth 1 or 2; laterals 1—1; or obsolete; interior dull, *obliquely furrowed*; pallial line simple; muscular impressions two, *elongated*, *rugose*, ligament external or sub-internal.

Genus Lucina. Brug. (653-655.)

Shell *orbicular*, *white*, sometimes divaricately striate; umbones depressed; lunule distinct; margins smooth or minutely crenulated; ligament oblique, *semi-internal*; hinge-teeth 2—2, latterals 1—1 and 2—2 or obsolete; muscular impressions rugose, anterior elongated within the pallial line, posterior oblong; umbonal area with an oblique furrow. *Dist.*—Universal.

Sub-Genus. Cyclas. Klein.

Valves divaricately striate.

Genus Loripes. Poli. (656.)

Shell almost equilateral, *cancellated or sculptured by flexuous striæ;* lunule short, cartilage *quite internal;* teeth one cardinal in the right and two in the left valve; laterals remote, and sometimes indistinct. *Dist.*—Atlantic, Mediterranean, W. Indies, Australasia.

(lxxxvi.) Family Ungulinidæ.

Genus Mysia. (657.)

Shell *sub-orbicular smooth;* ligament *double*, rather long, submarginal; hinge-teeth 2·2, of which the anterior in the left valve, and posterior in the right are bifid; muscular impressions polished, anterior elongated. *Dist.*—West Indies, Rio, Britain, Mediterranean, Red Sea, West Africa, India, Corea, Australia, California.

(lxxxvii.) Family Erycinidæ.

Shell *very small, thin, fragile, usually transparent*, and sometimes gaping, rounded or transverse, laterally depressed; hinge narrow, with one or two cardinal teeth, the lateral more or less elongated, compressed sometimes wanting; muscular impressions small, not well-marked; pallial line *simple*.

Genus Lasæa. (658-659.)

Shell minute and *roundish, oval;* beak straight; cartilage long, placed at the *shorter end of the shell*, contrary to that in *Kellia;* left valve with a minute thorn-like cardinal tooth; and in each valve two remarkably strong lateral teeth. *Dist.*—Universal.

Genus Kellia. (660-661.)

Shell small, thin, sub-orbicular, closed, *beaks small;* margins smooth; ligament internal, interrupting the margin, or on the thickened margins; cardinal teeth 1 or 2, laterals 1—1 in each valve. *Dist.*—Norway, New Zealand, California.

(lxxxviii.) Family Crassatellidæ.

Genus Crassatella. (662-664.)

Shell *solid, ventricose*, attenuated behind, smooth or concentrically furrowed; lunule distinct; *ligament internal;*

margin smooth or denticulated; pallial line simple; hinge-teeth 1·2, striated in front of cartilage-pit; lateral teeth 0—1, 1—0; adductor impressions deep, rounded; pedal small, distinct. *Dist.*—Australia, New Zealand, Philippines, India, West Africa, Canaries, Brazil.

(lxxxix.) Family Astartidæ.

Shell *thick, solid, equivalve,* the cardinal teeth always well developed, 2—3 in each valve; lateral teeth sometimes present on one or both sides, ligament always external, strong; muscular scars ovate, the anterior usually with a small deep superimposed pit, produced by the retractile muscles of the foot; pallial line entire.

Genus Cardita. (665-668.)

Shell oblong, *radiately ribbed;* ligament external; *margins toothed;* hinge-teeth 1·2, and an elongated posterior tooth; *pallial line simple;* anterior pedal scar close to adductor. *Dist.*—Universal.

Genus Mytilicardia. (669-670.)

Shell *elongated, very inequilateral,* with *squamous radiating ribs;* hinge with an anterior triangular cardinal tooth; posterior cardinal tooth double in the left valve; no anterior laterals. Foot rounded, grooved, byssiferous. *Dist.*—Universal.

(xc.) Family Unionidæ.

Genus Unio. (671.)

Shell *nacreous; epidermis thick and dark, oval or elongated, smooth,* corrugated, or spiny, becoming very solid with age; anterior teeth 1·2, or 2·2, short, irregular; posteror teeth, 1·2, elongated, laminar. *Dist.—Fresh water.* Universal.

(xci.) Family Trigoniidæ.

Genus Trigonia. (672.)

Shell *trigonal, nacreous internally,* thick, *tuberculated* or ornamented with *radiating or concentric* ribs; posterior side angular; ligament small and prominent; hinge-teeth 2·3, *diverging, transversely striated; centre tooth of left valve divided;* pedal impressions in front of the posterior adductor, and one in the umbo of the left valve; anterior adductor impression close to the umbo; pallial line simple. *Dist.*—Australia.

(xcii.) Family Nuculidæ.

Shell oval, or *trigonal*, *small*, *nacreous within*; hinge composed of a *great number of transverse teeth*, interrupted by a *central pit* for the reception of the ligament, which is internal or external.

Genus Nucula. (673-674.)

Shell *trigonal*, with the umbones turned towards the short posterior side, smooth or sculptured; *epidermis olive*, *interior pearly*; margins *crenulated*; hinge *with prominent internal cartilage pit*, and a series of sharp teeth on each side; *pallial line simple*. *Dist.*—Northern and Arctic Seas; 10—180 fathoms; Siberia, Melville Island, New England, Britain, Mediterranean, Cape, Japan, Australia.

Genus Leda. (675-676.)

Shell resembling Nucula; oblong, rounded in front, produced and pointed behind; margins even; *pallial line with a small sinus*; umbonal area with a linear impression joining the anterior adductor. *Dist.*—Northern and Arctic Seas; 10—180 fathoms; Siberia, Melville Island, New England, Britain, Mediterranean, Cape, Japan, Australia.

(xciii.) Family Arcidæ.

Shell regular, equivalve, with *strong epidermis*; ligament exterior, occupying an area between the beaks; *hinge with a long row of similar comb-like teeth*; pallial line distinct; muscular impressions sub-equal; structure corrugated, with vertical tubuli in rays between the ribs of striæ.

Genus Arca. (677-681.)

Shell equivalve, or nearly so, thick, *sub-quadrate*, ventricose, strongly ribbed or cancellated; margins smooth or dentated, close or sinuated ventrally; hinge straight, teeth very numerous transverse; umbones anterior, separated by a flat, lozenge-shaped ligamental area, with numerous cartilage grooves; pallial line simple; posterior adductor impression double; pedal scars two, the posterior elongated. *Dist.*—World-wide, most abundant in warm seas; low-water, 230 fathoms.

Genus Pectunculus. (682-685.)

Shell *orbicular*, nearly equilateral, smooth or radiately striated; umbones central, divided by a striated ligamental area; hinge with a semi-circular row of transverse teeth; adductor sub-equal; pallial line simple;

margins crenated inside. *Dist.* — West Indies, Britain, India, New Zealand, West America; ranging from 8 to 60, rarely 120 fathoms.

Genus Limopsis. (685.)

Shell orbicular, convex, *slightly oblique*, ligamental area with a *triangular cartilage pit* in the centre; hinge with two equal curved series of transverse teeth. *Dist.*—Red Sea (Nyst.), Japan, Britain, Tasmania. Mr. M'Andrew has dredged L. *Pygmæa* living on the coast of Finmark.

(xciv.) Family Mytilidæ.

Shell equivalve, *oval or elongated*, closed, umbones anterior, *epidermis thick and dark*, often filamentose; *ligament internal*, sub-marginal, very long; *hinge edentulous*; outer shell-layer obscurely prismatic-cellular; *inner more or less nacreous*; pallial line simple; anterior muscular impression small and narrow; posterior large, obscure.

Genus Mytilus. (686-691.)

Shell *wedge-shaped*, rounded behind, smooth in the typical species; umbones terminal, pointed; hinge-teeth minute or obsolete; pedal muscular impressions *two in each valve*, small, simple, close to the adductors. *Dist*—World-wide, Ochotsk, Behring's Sea, Russian Ice-meer, Black Sea, Cape Horn, Australasia.

Genus Modiola. (692-694.)

Shell *oblong, inflated in front*; umbones anterior, obtuse; hinge toothless; pedal impressions *three in each valve*, the central elongated; epidermis often produced into long beard-like fringes. *Dist.*—Universal.

Genus Modiolaria. (695.)

Shell rhomboidal, sculptured by two rows of striæ (one on each side), which radiate from the beaks, leaving the middle portion smooth; umbones incurved; hinge edentulous or crenulated, hinge-plate finely notched. *Dist.*—Temperate and Arctic Seas.

(xcv.) Family Aviculidæ.

Shell *inequivalve, very oblique*, resting on the smaller (right) valve, and attached by a byssus; epidermis indistinct; outer layer prismatic-cellular, *interior nacreous*; posterior muscular impression large, sub-central, anterior small within the umbo; pallial line irregularly

dotted; hinge-line straight, elongated; umbones anterior, eared, the posterior ear wing-like; cartilage contained in one or several grooves; *hinge edentulous or obscurely toothed.*

Genus Avicula. (696-697.)

Shell *obliquely oval, often thin diaphanous*, very inequivalve, *eared*, the *posterior ear produced wing-like*; right valve with a byssal sinus beneath the anterior ear; cartilage pit single, oblique; hinge with one or two small cardinal teeth, and an elongated posterior tooth, often obsolete; posterior muscular impressions (adductor and pedal) large, sub-central; anterior (pedal scar) small, umbonal. *Dist.*—Mexico, South Britain, Mediterranean, India, Pacific, Australasia; 20 fathoms.

Genus Crenatula. (698.)

Shell *thin, oblong compressed*, byssal sinus obsolete; cartilage pit shallow, crescent-shaped. *Dist.*—N. Africa, Red Sea, China, in sponges.

Genus Vulsella. (699.)

Shell *oblong, striated*, sub-equivalve, *with an inner pearly and outer fibrous layer;* umbones straight, earless. Often found imbedded in living sponges. *Dist.*—Red Sea, India, Australia, Tasmania.

(xcvi.) Family Pinnidæ.

Genus Pinna. (700.)

Shell equivalve, *wedge-shaped;* umbones quite anterior; posterior side truncated and gaping; ligamental groove linear, elongated; hinge edentulous; anterior adductor scar apical, posterior sub-central, large, ill-defined pedal scar in front of posterior adductor. *Dist.*—U. S., Britain, Mediterranean, New Zealand, Tasmania, Australia, Pacific, Panama.

(xcvii.) Family Spondylidæ.

Genus Spondylus. (701.)

Shell *irregular*, attached by the right valve, *radiately ribbed, spiny or foliaceous;* umbones remote, eared; ower valve with a triangular hinge-area, cartilage lin a central groove, nearly or quite covered; hinge of two curved interlocking teeth in each valve; adductor impression, double. *Dist.*—West Indies, Canaries, Mediterranean, India, Australasia, Torres Straits, Pacific, W. America, 105 fathoms.

(xcviii.) Family Pectinidæ.

Genus Pecten. (702-706.)

Shell *sub-orbicular*, regular, resting on the right valves, usually ornamented with *radiating ribs;* beaks approximate, *eared;* anterior ears most prominent; posterior side a little oblique; right valve most convex, with a notch below the front ear; hinge margins straight, united by a narrow ligament; cartilage internal, in a central pit; adductor impressions double, obscure; *pedal impression only in the left valve, or obsolete. Dist.*—World-wide, Nova-Zembla, Cape Horn; 200 fathoms.

(xcix.) Family Limidæ.

Shell *eared*, white, gaping at the sides; hinge edentulous, with a *central, triangular cartilage-pit.*

Genus Lima. (707-708.)

Shell equivalve, compressed, *obliquely oval;* anterior side straight, gaping, posterior rounded, usually close; umbones apart, eared; valves white, smooth, punctate, striate, or radiately ribbed and imbricated; there is usually a thin, brownish epidermis; hinge-area triangular, cartilage-pit central; adductor impression lateral, large, double; pedal scars two, small. *Dist.*—Norway, Britain, West Indies, Canaries, India, Australia, 1-150 fathoms. The largest living species (*L. excavata*, Chemn) is found on the Coast of Norway.

(c.) Family Anomiidæ.

Genus Placunanomia. (709.)

Shell adherent, sub-equivalve, *irregular, flattened;* hinge with two thick divergent elongated lamella in the inferior, corresponding with two long pit in the upper valve; upper valve with only two muscular impressions, the pedal scar radiately striated; the byssal plug is often fixed in the lower valve, and its muscle becomes (functionally) an adductor. *Dist.*—West Indies, Britain, New Zealand, California, Behring's Sea, Ochotsk; 50 fathoms. Mocine, California. *P. macrochissna*, Desh.

(ci.) Family Ostreidæ.

Genus Ostrea. (701-713.)

Shell *irregular*, attached by the left valve; upper valve *flat or concave*, often plain; lower *convex*, often plaited or

foliaceous, and with a prominent beak; ligamental cavity triangular or elongated; hinge toothless; structure *sub-nacreous*, laminated with prismatic-cellular substance between the margins of the laminæ. *Dist.*—Tropical and temperate seas, Norway, Black Sea, Australasia, etc.

BRACHIOPODA.

(cii.) Family TEREBRATULIDÆ.

Shell *minutely punctate;* usually round or oval, smooth or striated; ventral valve *with a prominent beak, perforated near or at the apex*, and attached by a portion of the valve itself; hinge with two curved teeth; dorsal valve with a depressed umbo, a prominent cardinal process between the dental sockets, and a *slender shelly loop*. (*Lamp shell.*)

Genus WALDHEIMIA. (714.)

Shell *smooth or plaited*, dorsal valve frequently impressed; *foramen complete;* loop elongated or reflected; septum of smaller valve elongated. *Dist.*—Norway, West Indies, Java, Australia, California, Cape Horn; low water, 100 fathoms.

Genus KRAUSSIA. (715-716.)

Shell small, *transversely oblong;* hinge-line nearly straight; beak truncated, laterally keeled; area flat; *foramen large, deltidum rudimentary;* dorsal valve longitudinally impressed, furnished inside with a forked process, rising nearly centrally from the septum; interior often strongly tuberculated. The Apophyses are sometimes a little branched. *Dist.*—S. Africa, Sydney, New Zealand; low-water to 120 fathoms. K. *rubra*, Pallas.

DESCRIPTIVE TERMS.

EXPLANATION OF TERMS COMMONLY USED IN DESCRIBING THE EXTERNAL CHARACTERS AND FORMS OF VARIOUS KINDS OF SHELLS.

Shells are said to be *external* when the animal is contained in them, and *internal* when they are concealed in the mantle; the latter, with many species devoid of shelly covering, are termed *naked* mollusca. The greater number of shells have but one shell (usually a closely-set spiral tube or cone,) and are termed *univalves*; the others are mostly composed of two valves (*bivalve*) hinged together, generally under the *beak or*

umbo. Some bivalves, as in Pholas and Barnea, have one or two accessory plates near the hinge, while the Chitons have eight imbricating valves like an articulated limpet, and are termed *multivalves.* The conical or flatly conical shells of the limpet group are usually *simple* and not *spiral.* The following are a list of terms applied to the principal distinguishing character of shells generally.

UNIVALVES.

Form of Shell.

	*Example fig. No.
I. (*a*) Regularly spiral.	
1. Elongated, subulate, elevated	32
2. Turreted, turriculate, an elongated shell with the whorls angulate or shouldered on their upper part	33
3. Cylindrical, pupiform	44, 45
4. Short, bucciniform	5
5. Fusiform, spindle-shaped	2, 3
6. Contabulate, short, with shouldered whorls	—
7. Globular, rounded	16
8. Depressed, lenticular	19
9. Discoidal, having the form of a disc or quoit	21, 22
10. Convolute, aperture about as long as the shell, nearly or quite concealing the spire	24, 25, 26, 28
11. Trochiform, pyramidal, conical, with a flat base	11
12. Turbinated, conical, with rounded base	9, 18
13. Cone shaped, obconic	27
14. Few whorled, whorls rapidly increasing	13, 36
15. Many whorled, whorls slowly or gradually increasing	12, 39
16. Ear-shaped	23
17. Subulate, awl-shaped	38
18. Acicular	40
(*b.*) Irregularly spiral, evolute	31
(*c.*) Tubular, tusk-like, tooth-like	46
(*d.*) Boat-shaped, slipper-shaped...	14, 15
(*e.*) Conical or limpet-shaped	57, 58, 59
(*f.*) Multivalve and imbricated	47

* See accompanying Plate.

Divisions of the Shell.

		Example fig. No.
II.	Apex, the posterior end of shell, or *nucleus*	5[a]
	1. The *nucleus* may be *reversed* or *sinistral*, turning to the left as in the body whorls of Physa ...	
	2. Dextral, turning to the right, normal condition	
	3. Oblique, when the nuclear whorls are set at an angle, unconformable with the body whorls ...	
III.	Whorl, a single complete revolution of the spiral cone	11[a]
	1. Periphery, that part marking its greatest circumference	8[a] 21[a]
	2. Suture, the line of channel formed by the junction of the whorls ...	5[c]
	3. Body-whorl usually capacious, the last turn ending with the aperture ...	36[a]
IV.	Base, anterior extremity opposite end to apex, usually the front of the aperture	11[a]
	1. Oblique, as in	20
	2. Concave, as in	20
	3. Convex, as in	19
	4. Flat, as in	11-12
V.	Aperture, the open mouth of the shell, the interior of which may be simple or entire, or may be channeled by a gutter or canal, more or less produced or everted (2.3). The aperture is :—	
	1. Longitudinal, when its greatest diameter is parallel to the axis of whorls	27
	2. Transverse, reverse of longitudinal ...	13
	3. Oblique, greatest diameter oblique to the axis	37
	4. Rounded, the circle slightly interrupted	9
	5. Auriform, ear-shaped	35
	6. Ovate, egg-shaped	36
	7. Oblong, rounded above and below, longer than wide	17
	8. Lunate, semi-lunar, semi-circular	16
	9. Triangular	

		Example fig. No.
10.	Linear, narrow	26
11.	Quadrate, squarish	13
12.	Patulous, dilated at its entrance ...	
13.	Compressed, diminished at its entrance	
14.	Produced, lengthened out	2d 3c
15.	Sometimes truncated, stunted, cut short abruptly at the end ...	5, 6, 33-34
VI.	Peristome. Sometimes peritreme. Margin of aperture. It is :— ...	
1.	Continuous or entire, as in ...	8, 9, 21, 44
2.	Interrupted, when the left side of aperture is formed only by the body-whorl	5
3.	The left side is formed either by the *inner* or *columella lip* (labrum) or partly by the body-whorl or *parietal wall.* The right side is formed by the *outer lip* (*labrum.*)	
VII.	Outer lip may be :—	
1.	Thin and sharp	7
2.	Thickened	1
3.	Reflected, curled outwards	8
4.	Inflected, curled inwards	25
5.	Expanded, swollen	1
6.	Digitate.	
7.	Foliated, fringed with spines.	
8.	Emarginate, incised, or slit	3a
9.	Effuse, when basal or anterior extremity is slightly produced, depressed, or reflected ...	32, 33, 34
10.	Sinuous, bent or curved interiorly. It may be :— ...	
11.	Dentate, toothed	3, 29
12.	Plicate or lamellate, when the teeth become rib-like.	
13.	Ringent, having *large* plications, nodules or teeth.	
14.	Deflected, deflexed, bent aside or backwards.	
VIII.	Inner lip or columella margin may have characters like those described under outer lip.	
IX.	Umbilicate. Perforate. When the base of the axis or columella, around which the whorls are coiled, is open	

Example fig. No.

or hollow (12ª.) It is *sub-umbilicated*, or *sub-perforate* when partly covered over by shelly matter (16). It is not umbilicated or non-perforate, where the axis of the shell is solid.

Sculpture or Colour Markings.

X. These are :—

1.	Longitudinal, when taking the direction of the axis.	
2.	Revolving or transverse, when they follow the spiral.	
3.	Canaliculate. Suture deeply channeled	5
4.	Cingulate. Encircled by revolving ribs	9
5.	Carinate, revolving sculpture prominent, sharp	9
6.	Sulcate, encircled by channels	10, 11
7.	Plicate, costate, ribbed. Sculpture longitudinal	4, 5, 8
8.	Nodosely, tuberculately, granosely plicate, when the ribs are broken up into tubercles or granules; mostly caused by the intersection of revolving sculpture	9
9.	Striate, covered by fine close lines, either longitudinal or revolving.	
10.	Punctate, pitted. Frequently punctate, striate, *i.e.*, 9 & 10 combined ...	11
11.	Granulate, nodose, tuberculate, covered with nodules of small or large size, but *not ribbed*	3
12.	Muricate, spinous, echinate when the nodules are *sharp pointed.*	
13.	Decussate, cancellate, longitudinal and revolving sculpture, crossing at *right angles.*	
14.	Reticulate, sculpture not crossing at right angles, irregularly decussate.	
15.	Clathrate, longitudinal and revolving lines both distant, forming a pattern somewhat like the iron bars of a prison window.	

Example fig. No.

16. Coronate, the upper part of the whorls having a series of revolving tubercles or spines 4
17. Varicose, when the external thickening of the outer lip of aperture occuring in some shells during rest-periods is not absorbed when growth is resumed, but remains crossing the whorls, rib-like, at regular intervals 1

XI. Operculum. A horny or shelly lid which closes the aperture of a large number of univalve shells. It is .—

1. Concentric when nucleus is central or sub-central.
2. Imbricated or lamellar when nucleus is marginal.
3. Claw-shaped or unguiculate, nucleus apical or in front.
4. Spiral, revolving gradually and growing on one edge.
5. Pauci-spiral, few rapidly increasing whorls.
6. Sub-spiral, scarcely spiral.
7. Multi-spiral, many whorled.
8. Articulated when it has a projection.
9. Radiated, modification of the articulated form in which the spiral is not so evident.

BIVALVES.

XII.

Arcuated, bent in the form of an arch.
Auriform, ear-shaped.
Auricled, having appendages like ears. ... (53)
Byssus, a beard.
Gibbous, bulging, swollen.
Compressed, squeezed together.
Concamerated, arched over, vaulted.
Concave, hollowed out ... ...
Concentrically rayed or ribbed, curved, with the umboe as a centre.
Cordate, cordiform, heart-shaped.
Crenulated, notched at the margin, scalloped ... ... (53)

Example fig. No.

Cuneiform, wedge-shaped ... ... (55)

Cylindrical, round, like a roller or cylinder.

Cymbiform, boat-shaped.

Denticulated, set with small teeth as in Arca.

Dexter valve, right valve.

Divaricated, spreading out widely.

Dorsal margin, the side on which the hinge is placed.

Elliptical, having the form of an ellipse.

Elongated, lengthened, drawn out.

Gap, gaping; when the valves are shut in some bivalves, as in Pholas, an opening is disclosed called the gap.

Globose, globular.

Hemispherical, in the shape of a half-globe.

Inequilateral, when the anterior and posterior sides make different angles with the hinge. *Equilateral*, having both sides alike.

Inequivalve when one valve is more convex than the other, or dissimilar in other respects, as in the common oyster.

Equivalve, having both valves alike.

Lenticulate, doubly convex, of the form of a lens.

Ligament, a solid body, softer than a cartilage, but harder than a membrane, which connects the valves. *External ligament* usually attached to ridges on the posterior, hinge-margin behind the umbones.
In some bivalves, as in Mactra, the ligament is internal, lodged in a cartilage furrow or pit.

Limb, the margin in bivalve shells.

Lobated, rounded at the edge.

Lunule, a crescent-like mark or spot, situated near the anterior and posterior slopes.

Nacred, nacreous, pearly.

Oblong-ovate, egg-shaped or oval.

Obsolete, indistinct, not well defined

Papyraceous, thin as paper.

	Example, fig. No.
Pectinated, resembling the teeth of a comb.	
Pinnated, winged.	
Quadrangular, having four right angles.	
Radiately, rayed or ribbed, rays or ribs springing from umboe, in the direction of limb or margins ...	(52)
Ridge, the upper part of a slope.	
Scalloped, indented at the edges.	
Serrated, having teeth like a saw.	
Serrulated, very minutely serrated.	
Sub-arcuated, somewhat arched.	
Sub-diaphanous, somewhat transparent.	
Transverse, breadth greater than length.	
Trapeziform, shaped like a trapezium.	
Trigonal, having three angles, deltoid.	
Turgid, swollen.	
Ventral margin, the margin opposite the hinge-margin.	
Ventricose, inflated or swelled in the middle.	
Umbo, the beak or round part which turns over the hinge.	

NOTE.—Many of the terms relating to the sculpture of univalves, are also applicable to the sculpture of bivalves.

LENGTH, BREADTH AND THICKNESS.

The hinge line of bivalves indicates the direction of the *length* of the shell, and the actual length is the maximum distance between lateral margins.

The breadth is the greatest diameter measured transversely to length.

The thickness is the greatest diameter of an imaginary line passing through one or both valves.

LIGAMENT.

The *valves* of the Pelecypods are bound together by a *ligament*, (49[c]) and usually articulated by a *hinge* furnished with interlocking teeth. The shell is closed by (either one or two) powerful *adductor muscles* (53[a]) but opens spontaneously by the action of the *ligament* when the animal relaxes, and after it is dead.

Example fig. No.

Umbo.

The *apex, beak or umbo* (49[d]) is the point from which the growth commences and is situated near the hinge. The beaks are either straight, as in Pecten, curved as in Venus or Cardium, or spiral, as in Isocardia.

Right and Left Valve.

When a shell is placed so that the dorsal margin is furthest from the observer, with the exterior side of valve uppermost, the position of the ligament to the right indicates the left valve, if to the left the right valve.

The *lunule* is a small cordate or semi-circular impression under and anterior to the beaks. When this appears to the right the valve is right, and *vice-versa*.

The *sinus* or *flexure* (fig. 49[e]) of the pallial impression (48[c]) when present is seen under the ligament. When the inside surface is viewed with the dorsal margin furthest from observer, if to the right it indicates the right valve, and *vice-versa*. Sometimes there are posterior lateral teeth, or laminæ of the hinge-margin, and are found on the right or left side accordingly as the valve is right or left. Thus the *pallial sinus*, the *external ligament*, (49[c]) and the *posterior slope* (49[a]) are to the right side, (the internal surface being exposed with the beak furthest from observer,) in the *right valve* (49), and *vice-versa*.

Linnæus and the older naturalists were wont to describe the front of the shell as the back and the right valve as the left.

Example fig No.

HINGE-LINE AND TEETH.

The dorsal margin on which the ligament and teeth are situated is termed the *hinge-line*. It is long and straight in Arca, short in Vulsella, and curved in most genera.

The central teeth immediately under umbo are called *hinge* or *cardinal* teeth (48[a]), those on each side are *lateral* teeth (48[b]), either the *cardinal* or the *lateral* teeth may be lacking in many shells, while in some teeth are entirely absent.

EDENTULOUS.

The dentition formulæ are usually stated as follows :—Cardinal teeth 2·3 or $\frac{2}{3}$—meaning 2 in the *right* valve, 3 in the left; lateral teeth, 1—1, 2—2, or 1 anterior and 1 posterior in *right* valve, 2 anterior, and 2 posterior lateral teeth in the *left* valve.

ADDUCTOR OR MUSCULAR IMPRESSIONS. (49[f.g.])

The greater number of bivalves have two *adductor muscles*, whose *impressions or scars* on the shell, nearly equal in size, are situated respectively on the anterior and posterior sides at the extremities of the hinge-line. In Mytilus, Modiola, these two *adductor impressions* are unequal, the posterior one being very much larger. In the Pectens, Oysters and Limas, there is only *one* strong *adductor impression* (53[a]), placed more centrally. The single *muscular scar is* not quite central, but nearer the posterior than the anterior side.

EPIDERMIS. SCARF OR SKIN.

All bivalve shells are clothed with an *epidermis*, *scarf*, or *skin*. Inconspicuous in some, but remarkably developed in others.

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28	————————Fresh water Shells of Tasmania ...	*1875
29	————————On some Marine Shells (recent additions not embraced in Census)	*1877
30	————————Observations on *Patellidæ and Nudibranchiata,* and Ampullaria (?) Amnicola...	*1876
31	————————On some new Marine Shells (not embraced in Census.) (Roy. Soc. Vic.)	1877-8
32	————————On some Tasmanian Trochidæ ...	*1879
33	*Johnston, R. M.*—Further notes on Tasmanian Fresh Water Shells, with descriptions of seven new species	*1877
34	————————Notes on the distribution and variability of Tasmanian Land Shells	*1878-9

Index No.		Year of *Publication.*
35	*Johnston, R. M.*—Table showing the general distribution of Tasmanian Land Shells	*1879
36	*Tenison - Woods*—On some Tasmanian Fresh Water Shells	*1878
37	————————On some new Marine Mollusca. (Roy. Soc. Vic.)	1877
	** Published in Proc. Roy. Soc. of Tas. in each year as stated.*	
38	Beddome, Lieut. C.E.—Description of three new Helices. (Proc. Roy. Soc. Tas.)	1878-9
39	*Johnston, R. M.*—Note on the discovery of *Turbo circularis* on Flinder's Island, and of the habitat of *Amnicola* (*Ampullaria ?*) *Tasmanica*, T. Woods ; also a description of a new species of Helix. (Proc. Roy. Soc. Tas.) ..	1878-9
40	*Petterd, W.*—A Monograph of the Land Shells of Tasmania, describing 79 species	1878-9
41	*Tenison-Woods*—Notes on *Bithynella*, etc. (Proc. Roy. Soc. Tas.)	1879
42	*Tate, Prof. Ralph*—On some Australian Slugs. (Proc. Roy. Soc. Tas.)	1880
43	Beddome, Lieut. C.E.—Description of two new Marine Shells. (Proc. Roy. Soc. Tas.)	1881
44	Tate, Prof. Ralph —Type species of Tasmanian Shells. (Proc. Roy. Soc. Tas.)	1881
45	*Tate and Brazier*—Check list of the Fresh Water Shells of Australia. (Proc. Linn. Soc., N.S.W.)	1881
46	*Hutton, Prof., F. W.*—Manual of the New Zealand Mollusca. (Wellington.)	1880
47	*Hutton, Prof., F. W.*—Notes on New Zealand *Hydrobiinæ, Pulmonate* Mollusca, etc. (Trans. N. Z. Institute) ...	1881
48	*Johnston, R. M.*—Notes on the discovery of a species of Pupa (*P. Lineolensis*) at Swansea, not hitherto recorded as existing in Tasmania. (Proc. Roy. Soc. Tas.) ...	1882
49	*Beddome, Lieut. C.E.*—Description of some new Marine Shells. (Proc. Roy. Soc. Tas.)	1882
50	*Smith, Edgar A.*—On the Fresh Water Shells of Australia. (Jour. Linn. Soc. Zool. xvi.-92)	1882
51	*Johnston, R. M.*—Notes regarding certain Fossil Shells occurring at Table Cape, supposed to be identical with living species. Two communications. (Proc. Roy. Soc. Tas.)	1884
52	*Tate, Prof. Ralph*—Critical examination of the Mollusca of the Older Tertiary of Tasmania, alleged to have living representatives. (Proc. Roy. Soc. Tas.) ...	1884
53	*Petterd, W. F.*—New species (5), of Tasmanian Marine Shells. Two papers. (Proc. Roy. Soc. Tas.) ...	1885
54	*Tate, Prof. Ralph*—On the Australian Pectens, confounded with the New Zealand *P. laticostatus.* Gray. (Proc. Roy. Soc. Tas.)	1886
55	*Brazier, John*—The Trochidæ and other Genera of Mollusca from Tasmania, with their synonyms. (Proc. Roy. Soc. Tas.)	1886
56	*Johnston, R. M.*—Notes with respect to the Land and Fresh Water Molluscs of King's Island. (Proc. Roy. Soc. Tas.)	1887

Index No.		Year of *Publication.*
57	*Petterd, W. F.*—Contributions for a Systematic Catalogue of the Acquatic Shells of Tasmania. (Proc. Roy. Soc. Tas.)	1888
58	*Johnston, R. M.*—Critical Observations on recent contributions to our knowledge of the Fresh Water Shells of Tasmania. (Proc. Roy. Soc. Tas.)	1888
59	———————Observations on the variability of the Tasmanian Unio. (Proc. Roy. Soc. Tas.)	1888
60	*Tenison-Woods*—On the Anatomy and Life History of Mollusca peculiar to Australia. Prize Essay. (Roy. Soc. N.S.W.)	1888
61	*Tate, Prof. Ralph*—Supplement to a list of the Lamellibranchs and Palliobranchs, etc., of South Australia, with a census of the Molluscan Fauna of Australia. (Trans. Roy. Soc. S.A.)	1888

CLASSIFIED LIST OF SPECIES.

(The numbers to the extreme right refer to index number of the publications containing fuller particulars or descriptions recorded in the Bibliography pages 71, 72.)

Class CEPHALOPODA.

(i.) Family Octopidæ. (sp. 2.)

1	Octopus maorum. *Hutton*	27, 46
2	Pinnoctopus cordiformis. *Quoy*	46

(ii.) Family Argonautidæ. (sp. 1.)

3*	Argonauta tuberculata. *Shaw*	27, 46

(iii.) Family Loligniidæ. (sp. 2.)

4	Sepioteuthis Lessoniana. *Feruss*	46
	———————— bilineata. *Quoy and Gaim.*	46

(iv.) Family Onychoteuthidæ. (sp. 2.)

5	Onychoteuthis Bartlingu. *Lesuer*	27, 46
6	Ommastrephes Sloanii, Gray	46

(v.) Family Spirulidæ. (sp. 1.)

7*	Spirula Peronii. *Lam.* (*D. Lævis Gray*)	27

(vi.) Family Nautilidæ. (sp. 1.)

8	Nautilus Pompilius. *Linn.*	

Class GASTROPODA.

(*Prosobranchiata.*)

(vii.) Family Muricidæ. (sp. 20.)

9 Murex triformis. *Reeve* 27
10 ——— zonatus. *T. Woods.* Supposed to be a young variety of M. Triform 27
11 ——— Angasi. *Crosse* 27
12 Arosalpinx typica. Dunker. (*Adamsia et Agnewia.*) T-Woods 27
13 Typhis arcuatus. *Hind's Voyage of Sulphur* *27
14 Trophon umbilicatus. *T.-Woods* *27
15 ——— squamosissima. " ... ... †
16 ——— Petterdi. *Crosse* 27
17 ——— Brazieri. *T.-Woods* 27
18 ——— Assisi. " 27
19 ——— Mariæ. " 27
20 ——— Hanleyi. " 27
21 ——— Goldsteini. " 27
22 ——— Australis. " 27
23 Purpura textilosa. *Lam.* 27
24 ——— humilis. *Crosse* 27
25 ——— succincta. *Martyn* 27
26 ——— madreporarum. *Sow.* 27
27 ——— (?) littorinoides. T.-Woods 27
28 ——— propinqua. T.-Woods 27

(viii.) Family Tritonidæ. (sp. 8.)

29 Triton cutaceus. *Linne* 27
30 ——— *Spengleri. Dillwyn.* (Regarded by *T.-Woods* as a variety of *T. cutaceus* 27
31 ——— *Waterhousei. Ad. and Angas.* May also be simply a small variety of T. cutaceus 27
32 ——— Quoyi. *Reeve* 27
33 ——— subdistortus. *Lam.* 27
34 Ranella leucostoma. Lam. 27
35 ——— *vexillum ? Sow.* 27
36 ——— epitrema. T.-Woods 27

(ix.) Family Fusidæ. (sp. 9.)

37 Fusus dilatata. *Quoy and Gaim.* 27
38 ——— pyrulatus. *Reeve, Icon* 27
39 ——— Novæ-Hollandiæ. *Reeve, Icon...* 27
40 ——— Tasmaniensis. *Adams and Angas* 27
41 ——— Legrandi. *T.-Woods...* 27
42 ——— Spiceri. " 27

43	Fasciolaria fusiformis. *Valenc*	27
44	——— coronata. *Lam.*	27
45	——— *trapezium.* Linne. (Reeve considers this form a variety of F. coronata.)	27

(x.) Family BUCCINIDÆ.) (sp. 15.)

46	Siphonalia Clarkei. *T.-Woods*	27
47	——————— turrita. *T.-Woods*	27
48	——————— fuscozonata. *Ad. and Angas* ...	27
49	Cantharus, Petterdi. *Brazier.* (*Tritonidæ.* Woods and Brazier)	27
50	Pisania reticulata. *T.-Woods*	27
51	——— Tasmanica. "	27
52	Cominella tenuiscostata. "	27
53*	——— alveolata. *Kiener*	27
54 ?	——— lactea. *Reeve, Icon*	27
55	——— Tasmanica. *T.-Woods*	27
56	——— costata. *Quoy*	27
57	——— Angasi. *Crosse*	27
58	——— albo-lirata. *T.-Woods*	27
59	——— (Josepha), Tasmanica "	27
60	Eburna (Zemira), Australis. *Sow.*	27

(xi.) Family NASSIDÆ. (sp. 5.)

61	Nassa Fasciata. *Lam.*	27
62	——— pauperata. *Lam.*	27
63	——— rufocincta. *A. Adams*	27
64	——— Jacksoniana. *Kiener*	27
65	——— Tasmanica. *T.-Woods*	27

(xii.) Family VOLUTIDÆ. (sp. 7.)

66	Voluta Angasi. *Sow.*	27
67	——— fusiformis. *Swainson*	27
68	——— papillaris. "	27
69	——— mitræformis. *Lam.*	27
70	——— mamilla. *Gray*	27
71	——— *Kingii. Cox.* (Probably only a variety of *V. Angasi*)	27
72	——— Sclateri. *Cox*	27

(xiii.) Family MITRIDÆ. (sp. 14.)

73	Mitra Badia. *Reeve*	27
74	——— glabra. *Swainson*	27
75	——— Australis. "	27
76	——— pica. *Reeve*	27

77	Mitra declivis. *Reeve.*	May be a variety of M. glabra. (T.-Woods)	...	...	...	...	27
78	——- capensis. *Dunker.*	(*M. Weldii.* T.-Woods)	...				27
79	——- Tasmanica. *T.-Woods*		...	...	...		27
80	——- Scalariformis.	"	...	...	...	...	27
81	——- Legrandi.	"	...	...	...	...	x†
82	——- Teresiæ.	"	...	...	...	...	v†
83	——- scita.	"	...	...	...	...	27
84	——- granatina.	*Swainson and T.-Woods*	...	...			27
85	——- Franciscana.	*T.-Woods*	...	...	...		27
86	——- semilivida	"	...	...	...		27

(xiv.) Family MARGINELLIDÆ. (sp. 10.)

87	Erato pellucida. *T.-Woods*	...	...	...		27
88	Marginella Muscaria. *Lam.*	...	...	...		27
89	——-- turbinata. *Sow.*	...	...	...		27
90	——-- formicula. *Lam.*	...	...	...		27
91	——-- Volutiformis. *Reeve*	...	...	...		27
92	——-- Tasmanica. *T.-Woods*	...	...	...		27
93	——-- Stanislas. "	...	...	...		27
94	——-- minutissima "	...	...	...		27
95	——-- Allporti. "	...	...	...		27
96	——--—— Petterdi. *Beddome*	...	...	...		27

(xv.) Family OLIVIDÆ. (sp. 5.)

97	Olivella Australis. *T.-Woods*	...	...	...	27	31
98	Oliva hieroglyphica. Reeve	...	...	...		27
99	Ancillari marginata. *Lam.* ...	...	...	...		27
100	——- fusiformis. Petterd	...	...	...		53
110	——- obtusa "	...	...	...		53

(xvi.) Family COLUMBELLIDÆ. (sp. 12.)

102	Columbella semi-convexa. *Lam.*	...	...	...		27
103	—— Lincolnensis. *Reeve*	...	...	...		27
104	—— irrorata. "	...	...	...		27
105	—— Roblini. *T.-Woods*	...	...	...		27
106	—— Xavierana. "	...	...	...		27
107	—— Legrandi. "	...	...	...		27
108	—— miltostoma "	...	....	...		27
109	—— badia "	...	...	...		27
101	—— (Aesopus) pilosa. *Angas*		...	...		27
111	—— minima. "		...	...		27
112	—— dictua. *T.-Woods*	...	...	...		31
113	—— *rosacea (?) Reeve.*	Probably identical with C. semi-convexa. *Tate.*)	...	...		44

(xvii.) Family CANCELLARIDÆ. (sp. 4.)

114	Cancellari lævigata. *Sow.*		27
115	——— undulata "		27
116	——— Tasmanica. *T.-Woods*		27
117	—— —— excavata. *Sow.*		27

(xviii.) Family TEREBRIDÆ. (sp. 6.)

118	Terebra bicolor. *Angas.* (*Acus.* Angas and Woods)		27
119	——— (Hastula.) Brazieri. *Angas*		27
120	——— Sp. indet. *T.-Woods*		27
121	——— addita. *Desh.*		27
122	——— Kieneri. "		27
123	——— nitida. Hinds		27

(xix.) Family PLEUROTOMIDÆ. (sp. 29.)

124	Pleurotoma (Drillia) Coxi. *Angas*		27
125	——— " incrusta. *T.-Woods*		27
126	——— " pseudo-carinata. *Reeve*		27
127	——— " *Angasi ?*		27
128	——— " Atkinsoni. *T.-Woods*		27
129	——— " minuta. "		27
130	——— " Weldiana. "		27
131	——— " Beraudiana. *Cross*		27
132	——— " tæniata. *T.-Woods*		27
133	——— " Agnewi. "		27
134	——— " Legrandi. *Beddome*		49
135	——— Bela mitralis. *Ad. and Angas*		27
136	——— (Clathurella) Philomenæ. *T.-Woods* ...		27
137	——— " granulosissima. "		31
138	——— " sculptilior "		31
139	——— (Daphnella) Tasmanica. *T.-Woods* ...		27
140	——— " varix. " ...		27
141	——— (Cythara) Tasmanica " ...		27
142	——— (Mangelia) St. Gallæ " ...		27
143	——— " Desalesii " ...		27
144	——— " Atkinsoni " ...		27
145	——— " Meredithæ " ...		27
146	——— " immaculata " ...		27
147	——— " Le-Tourneuxiana. *Crosse* ...		27
148	——— " Harrisoni. *T.-Woods*		31
149	——— " delicatula "		31
150	——— " alternata "		31
151	——— " trachys "		31
152	——— " cancellata. *Beddome*		49

(xx.) Family CONIDÆ. (sp. 5.)

153 Conus Novæ-Hollandiæ. *Adams* 27
154 ——— pontificalis. *Lam.* 27
155 ——— Tasmaniæ. *Sow.* 27
156 ——— rutila. ( ) *C. Macleay and T.-Woods* 27
157 ——— Carmeli. *T.-Woods* 27

(xxi.) Family CYPRÆIDÆ. (sp. 8.)

158 Cypræa *Annulus.* *Linne* 27
159 ——— angustata. *Gray* 27
160 ——— piperata. *Soland.* 27
161 ——— Comptoni. *Gray* 27
162 ——— (Cyprovula) umbilicata. *Sow.* 27
163 ——— *Scotti ?* *Brod.* 27
164 ——— (Trivia.) Australis. *Lam.* 27
165 Ovulum. (Volva.) Maccoyi. *T.-Woods.* (*Birostra.* T.-Woods) 27

(xxii.) Family CASSIDIDÆ. (sp. 5.)

166 Cassis. (Semi-cassis) semigranosa. *Lam.* 27
167 ——— " tumida. *Petterd* 53
168 ——— (Cassmaria) pyrum. *Lam.* 27
169 ——— " *nivea.* *Brazier.* Regarded by T.-Woods as a variety of *C. pyrum* 27
170 ——— (Cassmaria) Paucirugus. *Menke* 27

(xxiii.) Family NATICIDÆ. (sp. 9.)

171 Natica conica. *Lam.* 27
172 ——— Beddomei. *R. M. Johnston.* (Proc. Roy. Soc. Tas., 1884. P. 221. *N. polita.* T. Woods.) ... 27
173 ——— Tasmanica. *T.-Woods* 27
174 ——— nana. " 27
175 ——— Strangei. " 27
176 ——— (Mamilla.) umbilicata. Quoy 27
177 ——— " globosa. *T.-Woods.* Probably merely a white variety of *N. umbilicata* 27
178 Sigaretus zonalis. *Quoy* 27
179 Lamellaria. Sp. indet. North West Coast. (T. R. Atkinson.) 27

(xxiv.) Family CALYPTRÆIDÆ. (sp. 8.)

180 Infundibulum calyptræformis. *Lam.* (*Trochita*, T.-Woods) 27
181 Legrandia Tasmanica. *Beddome* 43
182 Calyptræa Harrisoni. *Beddome.* (*Cemoria*, *Beddome*) ... 43
183 *Crepidula* (*sp ?*) Waterhouse Island 27
184 ——— (*sp ?*) Frederick Henry Bay 27

185 *Hipponyx* foliacea. Quoy. (*Cochlolepas*, T.-Woods) ... 27
186 ——— subrufa. Sow. (*Cochlolepas*, T.-Woods ... 27
187 ——— (Amalthea) Conica. *Schum.* 27

(xxv.) Family Solariidæ. (sp. 3.)

188 Solarium, luteum. Lam. 27
189 ———. Sp. indet, Recherche 27
190 Adeorbis picta. T.-Woods 27

(xxvi.) Family Scalaridæ. (sp. 12.)

191 Scalaria Australis. *Lam.* 27
192 ——- (Cirostrema) varicosa. *Lam.* 27
193 ——- granulosa. *Quoy* 27
194 ——- aculeata. *Sow.* 27
195 ——- *delicatula. Crosse.* 27
196 ——- *Jukesiana. Forbes* 27
197 ——- lineolata. *Sow.* 27
198 ——- *Philippinarum ? Sow* 27
199 ——-
200 ——- (Crossea) labiata. *T.-Woods* 27
201 ——- (") concinna. *Angas, B.* 49
202 ——- (") cancellata. *T.-Woods.* (*Delphinula Johnstoni.* Beddome) 49

(xxvii.) Family Ianthinidæ. (sp. 3.)

203* Ianthina communis. *Lam.* 27
204* ——— *exigua. Lam.* 27
205 ——— bipartita. *Gray ?* 27

(xxviii.) Family Turritellidæ. (sp. 5.)

206 Turritella Tasmanica. *Reeve* 27
207 ——— granulifera. *T.-Woods* 27
208 ——— Tasmaniensis. " 27
209 ——— acuta. " 27
210 ——— sinuata. *Reeve* 27

(xxix.) Family Vermetidæ. (sp. 3.)

211 Vermetus dentiferous. *Lam.* 27
212 Siliquaria Australis. *Quoy.* (*Tenagodus*, T.-Woods) 27
213 ——— Weldii. *T.-Woods.* (" ") 27

(xxx.) Family Eulimidæ. (sp. 8.)

214 Eulima Tasmanica. T.-Woods 27
215 ——- micans. " 27
216 ——- proxima. *Sow.* 27

217	Eulima marginata.	*T.-Woods*	...	...	...	31
218	——— apheles.	"	...	...	...	31
219	——— Legrandi.	*Beddome*	...	...	...	49
220	——— Petterdi.	"	...	...	...	49
221	Stylifer Tasmanica.	*T.-Woods*	...	...	...	27

(xxxi.) Family TURBONILLIDÆ. (sp. 12.)

222	Turbonilla *Angasi.*	*Angas and T.-Woods*	...	...		27
223	——— Mariæ.	*T.-Woods*	..	...	...	27
224	——— Macleayana.	"	...	...	...	27
225	——— Tasmanica.	"	...	...	...	27
226	Aclis tristriata	"	...	..	...	27
227	Odostomia Tasmanica	"	...	...	...	27
228	——— (Parthenia) Tasmanica.	*T.-Woods*			...	27
229	——— lactea.	*Angas*	...	...	...	27
230	——— bifasciata.	*T.-Woods*	...	...	...	27
231	Syrnola Michæli.	"	...	...	...	27
232	——— bifasciata	"	...	...	...	27
233	Eulimella (Styloptygma.) Tasmanica.	*T.-Woods*			...	27

(xxxii.) Family LITTORINIDÆ. (sp. 11.)

234	Littorina unifasciata.	*Gray*	...	...	...	27
235	——— paludinella.	*Reeve*	...	...	...	27
236	——— Hisseyana.	*T.-Woods*	...	...	..	27
237	——— *undulata ?*	*Gray.* Probably a variety of *L. unifasciata*	...	...	...	... 27
238	——— *Philippi ?*	*Carpenter*	...	...	...	27
239	Risella nana.	*Lam.*	...	...	...	.. 27
240	——— melanostoma.	*Gmelin*	...	...	...	27
241	——— *aurata ?*	H. and A. Adams. Regarded by T.-Woods as a variety of *R. melanostoma*				... 27
242	Fossarus (Fossarina.) Petterdi.	*Crosse*	...	...		27
243	——— Tasmanicus.	*T.-Woods*	..	..	..	27
244	——— bulimoides.	"	...	...	...	27

(xxxiii.) Family PLANAXIDÆ. (sp. 3.

245	Alaba (Diala) monile.	*A. Adams.*	(*D. tessellata.* T.-Woods			27
246	——— " lauta.	"	(*D. punctata.* T.-Woods			27
247	——— " tumida.	T.-Woods	...	...	...	27

(xxxiv.) Family CERITHIIDÆ. (sp. 15.)

248	Cerithium dubium.	*Sow.* Tate states that Sowerby's name has priority over *C. monachus.* C. and Fisch	...	...	...	... 27, 44
249	——— rhodostoma.	*Adams*	...	...	...	27
250	——— serotina.	*A. Adams*	....	...	..	27

251	Cerithium *Diemense. Quoy and Gaim.* (Tate, P. 31-32. Proc. Roy. Soc. Tas., 1881.)		27
252	——— (Bittium) granarium. *Kiener*		27
253	——— " turritella. *Quoy*		27
254	——— " Lawleyanum. *Crosse*		27
255	——— " minimum. *T.-Woods*		31
256	——— " turboniloides. "		31
257	——— " semi-lævis "		31
258	——— (Cerithiopsis.) Atkinsoni. " (Perhaps a variety of *C. crocea* Angas) ...		27
259	——— " albosutura. *T.-Woods* ...		27
260	Triforis fasciata. T.-Woods		31
261	——— Tasmanica. "		27
262	Potamides (Lampania) Australis. *Quoy*		27

(xxxv.) Family RISSOELLIDÆ. (sp. 1.)

263. Tatea rufilabris. *A. Adams.* (*Tatea Huonensis.* T.-Woods. *Diala.* Adams.)

(xxxvi.) Family RISSOIDÆ. (sp. 48.)

264	Rissoina variegata. *Angas*		27
265	——— cincta. "		27
266	——— nivea. "		27
267	——— turricula. "		27
268	——— St. Claræ. *T.-Woods*		27
269	——— Flindersii. "		27
270	——— concatenata. "		27
271	——— Gertrudis "		27
272	——— Kershawi. "		31
273	——— supra-sculpta. "		31
274	——— uni-cirata. "		31
275	Rissoa Agnewi. "		27
276	——— cyclostoma. " var. *a rosea*		27
277	——— melanura. "		27
278	——— Angeli. " (Cyclostrema ?)		27
279	——— (Setia) Brazieri. "		27
280	——— " siennæ. *Assiminea Tasmanica.* T.-Woods		27
281	——— " Flamina. *Beddome*		49
282	——— (Cingula) Atkinsoni. *T.-Woods*		27
283	——— (Ceratia) Maccoyi. "		27
284	——— " puncto-striata. "		31
285	——— " Mariæ. "		27
286	——— (Alvania) cheilostoma. "		27
287	——— " fasciata. "		27
288	——— " Bayntoni "		49
289	——— minutissima. *T.-Woods*		27
290	Hydrobia *cristallina ? Pfr.* Petterd, Proc. Roy. Soc. Tas., 1888		57, 58

291	Hydrobia *Gunni ? Frauenfield.* Tate and Brazier, Proc. Linn. Soc., N.S.W., 1881		57, 58
292	Hydrobia *Tasmanica ? Martins.* Petterd, Proc. Roy. Soc. Tas., 1888		57, 58
293	Hydrobia, turbinata. *Petterd*		57, 58
294	Bithynella (Potomapyrgus ?)	nigra. *Quoy and Gaim* ...	57, 58
295	——— " ?	nitida. *R. M. Johnston.* (Fossil)	58
296	——— " ?	Dulvertonensis. T.-Woods...	57, 58
297	——— " ?	Dunrobinensis. " ...	57, 58
298	——— " ?	Dyeriana. *Petterd* ...	57, 58
299	——— " ?	Simsoniana. *Brazier* ...	57, 58
300	——— " ?	Woodsii. *Petterd*... ...	57, 58
301	——— " ?	Smithii. "	57, 58
302	——— " ?	Brownii. "	57, 58
303	——— " ?	marginata "	57, 58
304	Amnicola ? (Brazieria)	Tasmanica. *T.-Woods* (Amnicola)	57, 58
305	——— (Beddomeia)	Diemense. *Frauenfield.* Previously referred to *Amnicola* ...	57, 58
306	——— "	Launcestonensis. *R. M. Johnston.* Referred to Petterd's new Subgenus Beddomeia	57, 58
307	——— "	Bellii. *Petterd*...	57, 58
308	——— "	Lodderæ. "	57, 58
309	——— "	Hulli. "	57, 58
310	——— "	Tasmanica. *T.-Woods. Valvata*, T.-Woods	57, 58
311	Pomatiopsis striatula. *Menke*		57, 58
312	——— Badgerensis. *R. M. Johnston*		57, 58

(xxxvii.) Family ASSIMINIIDÆ. (sp 1.)

313	Assiminea bicincta. *Petterd*		57

(xxxviii.) Family VALVATIDÆ. (sp. 1.)

313a	*Valvata Tasmaniæ. T.-Woods.* Beddomeia Tasmanica		57

(xxxix.) Family TRUNCATELLIDÆ. (sp. 4.)

314	Truncatella scalarina. *Cox.* Petterd's Monograph ...		27
315	——— Tasmanica. *T.-Woods.* Petterd's Monograph		27
316	——— marginata. Kuster. " "		27
317	——— micra. T.-Woods. " "		27

(xl.) Family NERITIDÆ. (sp. 1.)

318	Nerita atrata. *Quoy*		27

(xli.) Family LIOTIIDÆ. (sp. 15.)

319	Liotia Tasmanica.	*T.-Woods*	...	...	...	27
320	—— discoidea.	"	...	...	...	27
321	—— Australis.	"	...	...	...	27
322	—— Angasi.	"	...	...	...	27
323	—— minima.	"	...	...	...	31
324	—— annulata.	"	...	...	...	31
325	Cyclostrema *Kingii*.	*Brazier*	...	...	...	27
326	—— Josephi.	*T.-Woods*	...	...	...	27
327	—— micra.	"	...	...	...	27
328	—— Weldii.	"	...	...	...	27
329	—— Susonis.	"	...	...	...	27
330	—— Spinosa.	"	...	...	...	27
331	—— immaculata	"	...	...	...	27
332	—— Bruniensis.	*Beddome*	...	...	...	49
333	—— Johnstoni.	"	...	...	...	49

(xlii.) Family ROTELLIDÆ. (sp. 1.)

334	Rotella (Ethalia) Tasmanica.	T.-Woods	...	...	x

(xliii.) Family PHASIANELLIDÆ. (sp. 5.)

335	Phasianella tritonis.	*Chemnitz*	...	...	27
336	—— sanguinea.	*Reeve*	...	...	27
337	—— Angasi.	*Jour. Conch, 1864*	...	...	27
338	—— rosea.	*Angas* ...	...	...	27
339	—— delicatula.	*T.-Woods*	...	...	27

(xliv.) Family TURBINIDÆ. (sp. 3.)

340	Turbo (Marmorostoma) undulatus.	*Chemnitz*		...	27
341	—— (Senectus) circularis.	*Reeve* ...	...	...	27
342	—— straminea.	*Martyn*	...	...	27

(xlv.) Family TROCHIDÆ. (sp. 46.)

343	Trochus tæniata.	*Quoy and Gaim.* ...	...	...	27
344	—— (Gibbula) Coxi.	*Angas* ...	...	...	27
345	—— " sulcosa.	*A. Adams*	...	...	27
346	—— (Zizyphinus) granulatus.	*Born*	...	...	27
347	—— " armillatus.	*Woods. Z. Meyeri, Philippi* (Br.)	...	...	27, 55
348	—— " fragrum.	*Philippi*	...	...	27
349	—— " incertus.	*Reeve*	...	...	27
350	—— (Monilea)	*roseus. T.-Woods*	...	...	27
351	—— "	*turbinatus.* "	...	...	27
352	—— (Minolia)	*Tasmanicus.* "	...	...	27
353	—— (Infundibulum) fimbriata.	*Swainson.* (*Carnidea.* T.-Woods)	...	...	27

354 Trochus (Infundibulum) Tasmanica. (*Carinidea.*) (*Carinidea.* T.-Woods) 27
355 ——— (Infundibulum) aurea. *Jonas.* (*Carinidea.* T.-Woods) 27
356 Trochus (Thalotia) conicus. *Gray.* *T. Picta,* T.-Woods (Br.) ... " 55, 27
357 ——— " dolorosa. *T.-Woods* 55, 27
358 ——— " tesselatus. " 31
359 ——— " dubium. " 31
360 ——— (Elenchus) badius. *Woods* 27
361 ——— " bellulus. *Dunker* 27
362 ——— " irisodontes. *Quoy* 27
363 ——— " nitidulus. *Phil. Kust* 27
364 ——— *Baudini* 44
365 ——— (Cantharidus) pulcherrimus. *Gray* 55
366 ——— " Lesueri. *Fischer.* (*T. picta,* T.-Woods)... 55
367* ——— (Bankivia) varians. *Bech.* 27
368 ——— (Trochochlea) Australis. *Favanne* 27
369 ——— " constrictus. *Lam.* 27
370 ——— " tæmatum ? *Quoy and Gaim* ... 27
371 ——— " compta. *T.-Woods* 27
372 ——— (Euchelus) canaliculatus. *Lam.* 27
373 ——— " Tasmanicus. *T.-Woods.* (*Fossarus Tasmanica*) T.-Woods. 27
374 ——— " scabriculus. *Ad. and Angas* ... 27
375 ——— (Clanculus) nodulosus. *A. Adams* 27
376 ——— " Aloysii. *T.-Woods* 27
377 ——— " Philomenæ. " 27
378 ——— " Dominicanæ. " 27
379 ——— " Raphæli. " 27
380 ——— " Angeli. " 27
381 ——— " conspersus. *A. Adams* 27
382 ——— " rubens. " 27
383 ——— " undatus. *Lam...* 27
384 ——— " Mangeri. *Adams* 27
385* ——— " variegatus. " 27
386 ——— " gibbosus. " 27
387 ——— " nodo-liratus " *Gibbula multicarinata, T.-Woods* (32) 27
388 (Astele) subcarinatus. *Swainson* 27

(xlvi.) Family STOMATELLIDÆ. (sp. 2.)

389 Stomatella imbricata. *Lam.* 27
390 Stomatia (Gena) strigosa. A. Adams 27

(xlvii.) Family PLEUROTOMARIIDÆ. (sp. 1.)

391 Schismope Atkinsoni. *T.-Woods.* (*Scissurella,* T.-Woods, 1876) 27

(xlviii.) Family HALIOTIDÆ. (sp. 4.)

392	Haliotis nævosa. *Martyn*	27
393	—— glabra. *Swainson*	27
394	—— carinata. *Martini*...	27
395	—— elegans. *Koch*	27

(xlix.) Family FISSURELLIDÆ. (sp. 13.)

396	Fissurella Australis. *Krauss*	27
397	—— scutella. Gray	27
398	—— nigrita. *Sow.*	27
399	—— concatenata. *Crosse*	27
400	—— crucis. Beddome	49
401	—— (Machroschisma) Tasmanica. *T.-Woods.* (Var. a, *Rosea.*) (T.-Woods.)	27
402	Emarginula emarginata. *Blainville*	27
403	—— rugosa. (Quoy?) *Sow.*	27
404	—— Tasmaniæ. *Sow.*	27
405	—— tenuicostata. "	27
406	Parmophorus elongatus. *Blainville.* (*Scutus* T.-Woods)	27
407	—— (Tugalia) Australis. *Sow.*	27
408	—— " Tasmanica. *T.-Woods* ...	27

(l.) Family PATELLIDÆ. (sp. 16.)

409	Acmæa septiformis. *Quoy*	27
410	—— marmorata. *T.-Woods*	27
411	—— crucis. "	27
412	—— costata. *Sow.*	27
413	—— cantharus. *Reeve*	27
414	—— flammea. *Quoy*	27
415	—— conoidea. "	27
416	—— Petterdi. *T.-Woods*	27
417	—— alba. "	27
418	Patella aculeata. *Reeve*	27
419	—— tramoserica. *Martyn*	27
420	—— decora. *Philippi*	27
421	—— ustulata. *Reeve*	27
422	—— Tasmanica. *T.-Woods*	27
423	—— Chapmani. "	27
424	—— radians. *Gmelin*	27

(li.) Family CHITONIDÆ. (sp. 11.)

425	Chiton (Lophyrus) Australis. (*R. Mag. Nat. Hist.* 1840)	27
426	—— (Lepidopleurus) liratus. *Ad. and Angas* ...	27
427	—— " speciosus. " ...	27
428	—— piceus. *Gmel.*	27
429	—— proteus. *Reeve*	27
430	—— *Sinclairi*? Gray	27

431	Chiton glaucus. "	27
432	——— (Plaxifora) petholatus. *Sow.* *C. ciliata.* Sow?	27
433	——— (Acanthochites) Zelandius. *Quoy.* Probably identical with *C. crinitas* Pennart, and *C. fasicularis*	27
434	Chitonellus (Cryptoplax) Gunni. *Reeve*	27
435	——— " spinosa. *A. Adams*	27

OPISTHOBRANCHIATA.

(lii.) Family PHILINIDÆ. (sp. 1.)

436	Philine aperta. *Linne*	27

(liii.) Family TORNATELLIDÆ. (sp. 2.)

437	Tornatina Mariæ. *T.-Woods*	27
438	Ringicula Australis. *Crosse*	27

(liv.) Family CYLICHNIDÆ. (sp. 2.)

439	Cylichna arachis. *Quoy and Sow.*	27
440	——— Atkinsoni. *T.. Woods*	27

(lv.) Family BULLIDÆ. (sp. 2.)

441	Bulla oblonga. *A. Adams*	27
442	Haminea obesa. *Sow.*	27

(lvi.) Family LOPHOCERCIDÆ. (sp. 1.)

443	Akera Tasmanica. *Beddome*	49

(lvii.) Family APLYSIIDÆ. (sp. 2.)

444	Aplysia concava. *Sow.*	27
445	——— Tasmanica. *T.-Woods*	27

PULMONATA.

(lviii.) Family VITRINIDÆ. (sp. 3.)

446	Vitrina Milligani. *Pfeiffer*	22, 34, 40
447	——— Verreauxi. "	22, 34, 40
448	——— fumosa. *T.-Woods*	34, 40

(lix.) Family HELICIDÆ. (sp. 73.)

449	Helix architectonica. *Brazier*	...	...		
450	—— antialba. (*Beddome*	...	...		
451	—— Bassi. *Brazier* ...	...	...		
452	—— Barrenensis. *Petterd*	...	...		
453	—— bisulcata. (Pfr.) .	...	...		
454	—— Bischoffensis. *Beddome*	...	...		
455	—— cellaria. *Mueller* * ...	...	...		
456	—— cæsus. *Cox*	...	...		
457	—— Collisi. *Brazier* ..	...	...		
458	—— Curaçoæ. "	...	...		
459	—— Diemenensis. *Cox*	...	...		
460	—— direlicta. "	...	...		
461	—— dispar. *Brazier*	...	...		
462	—— Du Cani. *Cox*	...	...		
463	—— Dyeri. *Petterd*	...	...		
464	—— Fordei. *Brazier*	...	...		
465	—— Furneauxensis. *Petterd*	...	...		
466	—— Gunni. *Brazier*	...	...		
467	—— Gadensis. *Beddome* ...	...	...		
468	—— Hamiltoni. *Cox*	...	..		
469	—— Hobarti. "	...	...		
470	—— Halli. "	...	...		
471	—— Henryana. *Petterd* ...	...	...		
472	—— Hookeriana. *R. M. Johnston* ...	...	...		
473	—— jungermanniæ. *Petterd*	...	...		
474	—— Kingi. *Brazier* ...	..	...		
475	—— Kershawi. *Petterd* ...	...	...		
476	—— lampra. (Pfr.) ...	...	...		
477	—— Launcestonensis. *Reeve*	...	...		
478	—— Legrandi. *Cox* ...	...	...		
479	—— lamproides. " ...	...	...		
480	—— Luckmani. *Brazier* ...	...	...		
481	—— limula. *Cox* ...	...	...		
482	—— Langleyana. *Brazier*	...	...		
483	—— Lottah. *Petterd* ...	...	...		
484	—— Morti. *Cox* ...	...	...	22, 35, 40	
485	—— mimosa. *Petterd* ...	...	...		
486	—— marchianæ. *Cox* ...	...	...		
487	—— M'Donaldi. " ...	...	...		
488	—— Mathinna. *Petterd* ...	...	...		
489	—— Nelsonensis. *Brazier*	...	...		
490	—— Officeri. *Cox* ...	...	...		
491	—— Otwayensis. *Petterd*	..	...		
492	—— parvissima. *Cox* ...	...	...		
493	—— positura. " ...	...	...		
494	—— plexus " ...	...	...		
495	—— Petterdi. *Brazier* ...	...	..		
496	—— pictilis. *Tate* ...	...	...		

* The three species so marked have been introduced from Europe, and are now abundant in Launceston and Hobart, in gardens or cellars.

497	Helix pulchella. *Mueller* *	...	...	...		
498	—— questiosa. *Cox*	...	...	...		
499	—— ruga "	...	...	...		
500	—— rotella. *Brazier*	...	...	...		
501	—— Roblini. *Petterd*	...	...	...		
502	—— Sinclairi. (Pfr.)	...	...	...		
503	—— subangulata. (Prf.)	...	...	...		
504	—— sitiens. *Cox*	...	...	...		
505	—— Stephensi. *Cox*	...	...	...		
506	—— subrugosa. *Brazier*	...	...	...		
507	—— Spiceri. *Petterd*	...	...	...		
508	—— Stanleyensis. "	...	...	...		
509	—— Savési. "	...	...	...		
510	—— Tasmaniæ. *Cox*	...	...	...		
511	—— tranquilla. "	...	...	...		
512	—— Trucanini. *Petterd*	...	...	...		
513	—— trajectura. *Cox*	...	...	...		
514	—— Tamarensis. *Petterd*	...	...	...		
515	—— vitrinaformis. *Cox*	...	...	...		
516	—— Wynyardensis. *Petterd*	...	...	...		
517	—— Weldii. *T.-Woods*	...	...	...		
517a	—— aspersa. "*	...	...	...		
518	—— Brunonia. *R. M. Johnston*	...	...	...	...	56
519	Bulimus Dufresni. *Leach*	...	...	...	...	22, 35, 40
520	——— Tasmanicus. *Pfeiffer*	...	...	...	...	22, 35, 40

(lx.) Family PUPIDÆ. (sp. 1.)

521	Pupa Lincolnensis. *Angas*	...	...	...	...	48

(lxi.) Family LIMACIDÆ. (sp. 1.)

522	Limax Legrandi. *Tate*	...	...	...	...	42

(lxii.) Family ARIONIDÆ. (sp. 1.)

523	Cystopelta Petterdi. *Tate*	...	...	...	...	42

(lxiii.) Family SUCCINEIDÆ. (sp. 4.)

524	Succinea Legrandi. *Cox*	...	...	...	...	22, 35, 40
525	——— Australis. *Pfeiffer*	...	...	...		22, 35, 40

(lxiv.) Family AURICULIDÆ. (sp. 4.)

526	Cassidula zonata. *H. and A. Adams. Auricula Dyerana*, T.-Woods, 27	...	...	...	...	32
527	Alexia Harrissoni. *Beddome*	...	...	...		49
528	Marinula pellucida. *Cooper*	...	...	...		27
529	Ophicardelus cornea. *Swainson. Auricula Australis.* Martyn	...	...	...	...	27

(lxv.) Family LIMNÆIDÆ. (sp. 27.)

530 Limnæa Sub-aquatilis. *Tate.* Var. a neglecta ... 57
531 —— Gunnii. *Petterd* 57
532 —— lutosa. " 57
533 —— stagnalis " (Introduced) 57
534 Amphipeplea Launcestonensis. *T.-Woods* 33, 57, 58
535 —— " ? (Var. *Papyracea*) Tate... 57
536 Physa Van Diemenensis. Sow. } Possibly var. of *P. nitida* 28, 33, 45, 58
537 —— aperta "
538 —— nitida. "
539 —— *Huonensis. T.-Woods*
540 —— Bruniensis. "
541 —— Tasmanicola "
542 —— Huonicola. "
543 —— eburnea. *Sow.*
544 —— *attenuata.* "
545 —— mamillata. "
546 —— *Tasmanica ? T.-Woods* } Possibly a var. of *P. nitida*
547 —— *Legrandi ? T.-Woods.* Possibly a var. of *P. nitida*
548 Planorbis meridionalis. *Brazier* } *P. Tasmanicus.* T.-Woods 33, 58, 57
549 —— Atkinsoni. *R. M. Johnston*
550 —— Scottiana. "
551 —— *Australianus.* Martens. Probably identical with *P. meridionalis.*
552 Ancylus Cumingianus. *Bourg.* 28, 33, 58
553 —— *Irvinæ ? Petterd.* Probably large variety of the variable *A. Cumingianus* 57, 58
554 —— Tasmanicus. *T.-Woods* 28, 33, 58
555 Gundlachia Petterdi. *R. M. Johnston* 33, 58
556 —— *Beddomei ? Petterd.* Probably a variety of *G. Petterdi* 57

(lxvi.) Family AMPHIBOLIDÆ. (sp. 3.)

557 Amphibola (Ampullarina) fragilis. *Quoy* 27
558 —— " Quoyana. *Desh.* 27
559 —— " minuta. *T.-Woods* 27

(lxvii.) Family SIPHONARIIDÆ. (sp. 3.)

560 Siphonaria Diemenensis. *Quoy* 27
561 —— denticulata. *Quoy and Gaim* 27
562 —— zonata. *T.-Woods* 27

CLASS SCAPHOPODA.

(lxviii.) Family DENTALIIDÆ. (sp. 2.)

563 Dentalium Tasmaniensis. T.-Woods 27
564 —— Weldiana. " 27

CLASS PELECYPODA.

(SINUPALLIATA.)

(lxix.) Family GASTROCHÆNIDÆ. (sp. 2.)

565 Aspergillum (Humphreya) Strangei 27
566 Gastrochæna Tasmanica. *T.-Woods*... 27

(lxx.) Family TEREDIDÆ. (sp. 1.)

567 Teredo navalis. *Gray* 27

(lxxi.) Family PHOLADIDÆ. (sp. 1.)

568 Barnea Australasiæ. *Gray* 27

(lxxii.) Family SOLENIDÆ. (sp. 1.)

569 Solen vaginoides. *Lam.* 27

(lxxiii.) Family SAXICAVIDÆ. (sp. 2.)

570 Saxicava Australis. *Lam.* 27
571 Panopæa Australis. Sow 27

(lxxiv.) Family CORBULIDÆ. (sp. 3.)

572 Corbula *Zelandica ?* Quoy. (Doubtful.) T.-Woods ... 27
573 ——— erythrodon. *Lam.* " " ... 27
574 Neræa Tasmanica. *T,-Woods* 27

(lxxv.) Family ANATINIDÆ. (sp. 11.)

575 Anatina anserifera. *Spengler* 27
576 ——— creccina. *Valence* 27
577 ——— Tasmanica. *Reeve* 27
578 ——— Angasi. *Crosse* 27
579 Myodora brevis. *Stutchbury* 27
580 ——— *ovata ? Reeve.* (Doubtful if identical with *Reeves'* species. (T.-Woods) 27
581 ——— pandoriformis. *Stutchbury* 27
582 ——— Tasmanica. *T.-Woods* 27
583 ——— albida. " 27
584 Myochäma anomioides. *Stutchbury* 27
585 ——— (sp. indet) 27

(lxxvi.) Family MACTRIDÆ. (sp. 4.)

586 Mactra rufescens. *Lam.* 27
587 ——— pura. *Deshayes* 27
588 ——— cretacea. Angas 27
589 Lutraria dissimilis. *Deshayes* 27

(lxxvii.) Family PAPHIIDÆ. (sp. 5.)

590 Paphia (Anapa) triquetrum. *Hanley* 27
591 ——— " Tasmanica. *T.-Woods.* Possibly a variety of *P. triquetrum* 27
592 ——— (Donacilla) elongata. *Deshayes* 27
593 ——— (Mesodesma) erycina. *Lam.* 27
594 ——— " precæsia. *Deshayes* 27
595 ——— " Diemenensis. *Quoy and Gaim* ... 44

(lxxviii.) Family SEMELIDÆ. (sp. 3.)

596 Semele decora. *A. Adams*... 27
597 ——— exigua. *H. Adams*... 27
598 ——— Warburtoni. *T.-Woods* 27

(lxxix.) Family TELLINIDÆ. (sp. 13.)

599 Tellina deltoidalis. *Lam.* 27
600 ——— albinella. " 27
601 ——— umbonella " 44
602 ——— diemenensis. *Deshayes* 27
603 ——— Tristis. " 27
604 ——— (Arcopagia) decussata. *Lam.* 27
605 ——— Mariæ. *T.-Woods* 27
606
607 Gari compta. *Deshayes* 27
608 ——— zonalis. *Lam.* 27
609 ——— Atkinsoni. *Brazier* 27
610 Hiatula epidermia. *Deshayes* 27
611 ——— vitrea. " 27

(lxxx.) Family VENERIDÆ. (Sp. 26.)

612 Venus (Chione) Humphreyi. *Donovan* 27
613 ——— " conularis. *Lam.* } *V. Aphrodinoides* 27
614 ——— " lamellata. " } *V. Scalarina* ... 27
615 ——— " Stutchburyi. *Gray* 27
616 ——— " roborata. *Hanley* 27
617 ——— " gallinula. *Lam.* 27
618 ——— " Macleayana. *T.-Woods* 27
619 ——— " striatissima. *Sow.* 27
620 ——— " Australis. " 27
621 ——— " lævigata. " 27
622 ——— " *fumigata* ? " Doubtful species ... 27
623 ———
624 Cytherea (Callista) Diemenensis. Hanley 27
625 ——— " planatella. *Chemnitz* ? 27
626 ——— " *candida* ? Deshayes. Unknown. (T.-Woods) 27
627 ——— " disrupta. *Sow.* 27
628 ——— " *citrina* ? *Lam.*... 27

629	Cytherea (Callista) *rutila ?*	*Deshayes.* (T.-Woods)	Doubtful.	...	...	27
630	———	"	Victoriæ. *T.-Woods*	...	...	27
631	——— (Gouldia.)	Petterdi.	"	...	...	27
632	Dosinia grata. *Deshayes*	...	...	...	...	27
633	——— *japonica ? Reeve.*	Doubtful. (T.-Woods.)			...	27
634	——— *coryne. A. Adams*	...	...	...	...	27
635	——— crocea. *Deshayes*	...	...	...	...	27
636	——— immaculata. *T.-Woods*	...	...	...	...	27
637	Tapes undulata. *Born.*	Rare.	...	...	...	27

INTEGRIPALLIATA.

(lxxxi.) Family CYRENIDÆ. (sp. 4.)

638	*Corbicula Brunnea ?* Prime.	Doubtful	...	...	44
639	Pisidium Tasmanicum. *T.-Woods*	...	...	...	28
640	——— Dulvertonensis.	"	...	..	...	28
641	Sphærium (Cyclas) Tasmanica. *T.-Woods*		...	...	28

(lxxxii.) Family PETRICOLIDÆ. (sp. 6.)

642	Rupellaria Diemenensis. *Quoy and Gaim*		...	...	27
643	——— *brevis ?*	"	Doubtful.		27
644	——— reticulata. *T.-Woods*		...	...	...	27
645	——— crenata. *Lam.* ...		...	...	...	27
646	——— sub-decussata. *Deshayes* ...		...	...	...	27
647	——— carditoides. *Lam.*		...	...	...	27

(lxxxiii.) Family CARDIIDÆ. (sp. 4.)

648	Cardium tenuicostatum. *Lam.*	...	...	...	27
649	——— pulchellum. *Reeve*	...	...	...	27
650	——— *papyraceum ? Chemnitz.*	Probably var. of *C. tenuicostatum*...	...	...	...	27
651	——— cygnorum. *Deshayes*	...	...	...	27

(lxxxiv.) Family CHAMIDÆ. (sp. 1.)

652	Chama (sp. indet) ...	...	...	...	...	27

(lxxxv.) Family LUCINIDÆ. (sp. 4.)

653	Lucina (Cyclas) divaricata. *Linne*	...	...	...	27
654	——— " minima. *T.-Woods*...		...	...	27
655	——— " pecten. *Lam.*	...	...	...	27
656	Loripes icterica *Reeve*	...	...	...	...	27

(lxxxvi.) Family UNGULINIDÆ. (sp. 1.)

657	Mysia Tasmanica. T.-Woods.	*Diplodonta.* T.-Woods			27

(lxxxvii.) Family ERYCINIDÆ. (sp. 4.)

658	Lasæa (Poronia ? australis. *Sow*	27
659	——— „ ? scalaris. *Phil.*	27
660	Kellia Atkinsoni. *T.-Woods*	27
661	——— (Pythina) Tasmanica, *T.-Woods* ...	27

(lxxxviii.) Family CRASSATELLIDÆ. (sp. 3.)

662	Crassatella Kingicola. *Lam.*	27
663	——— aurora. *Ad. and Angas*	27
664	——— Banksii. „	27

(lxxxix.) Family ASTARTIDÆ. (sp. 6.)

665	Cardita Raouli. *Angas*	27
666	——— Quoyi. *Deshayes*	27
667	——— Gunni. „	27
668	——— amabilis. „	27
669	Mytilicardia Tasmanica. *T.-Woods*	27
670	——— *excavata. Deshayes*	27

HOMOMYARIA.

(xc.) Family UNIONIDÆ. (sp. 1.)

671	Unio *Moretonicus?* Reeve. Very variable in form, probably one of the many varieties of *U. Australis*	28, 59

(xci.) Family TRIGONIIDÆ. (sp. 1.)

672	Tregonia Margaritacea. *Lam.*	27

(xcii.) Family NUCULIDÆ. (sp. 4.)

673	Nucula Grayi. *D'Orb.*	27
674	——— minuta. *T.-Woods*	27
675	Leda crassa. *Hinds*	27
676	—— Lefroyi. *Beddome*	49

(xciii.) Family ARCIDÆ. (sp. 9.)

677	Arca trapezia. *Desh.*	27
678	—— fasciata. *Reeve*	27
679	—— *semitorta.* *Lam.*	44
680	—— *pistachia* „	44
681	—— *squamosa* „	44
682	Pectunculus radians „	27
683	——— obliquus. *Reeve?*	27
684	——— *flabellatus. T.-Woods. P. orbicularis* ... Angas ?	44
685	Limopsis Tenisoni. *T Woods.*	27

HETEROMYARIA.

(xciv.) Family MYTILIDÆ. (sp. 10.)

686 Mytilus latus. *Lam.* 27
687 ——— *Tasmanicus.* *T.-Woods.* Doubtfully distinct from last 27
688 ——— Dunkeri. *Reeve* 27
689 ——— rostratus. *Dunker* 27
690 ——— hirsutus. *Lam.* 27
691 ——— crassus. *T.-Woods* 27
692 Modiola Australis. Gray. Doubtfully distinct from *M. tulipa.* (T.-W.) 27
693 ——— albicostata. *Lam.* 27
694 ——— arborescens. *Chemnitz* 27
695 Modiolaria Cumingiana. *Dunker* 27

(xcv.) Family AVICULIDÆ. (sp. 4.)

696 Avicula pulchella. *Reeve* 27
697 ——— (Meleagrina) *alba.* *Lam.* 44
698 Crenatula *modiolaris.* *Lam.* 44
699 Vulsella Tasmanica. *Reeve*... 27

(xcvi.) Family PINNIDÆ. (sp. 1.)

700 Pinna Tasmanica. *T.-Woods* 27

MONOMYARIA.

(xcvii.) Family SPONDYLIDÆ. (sp. 1.)

701 Spondylus tenellus. *Reeve* 27

(xcviii.) Family PECTINIDÆ. (sp. 5.)

702 Pecten meridionalis. *Tate.* 54. *P. fumatus.* Linne. T.-Woods 27
703 ——— asperrimus. *Lam.* 27
704 ——— bifrons. „ 27
705 ——— Atkinos. *Petterd.* Allied to *P. asperrimus* ... 53
706 ——— Mariæ. *T.-Woods* 27

(xcix.) Family LIMIDÆ. (sp. 2.)

707 Lima (Radula ?) lima. *Linne* 27
708 ——— „ bullata. *Born* 27

(c.) Family ANOMIIDÆ. (sp. 1.)

709 Placunanomia *Zealandica ?* Gray. Doubtful. ... 27

TABULAR SYNOPSIS OF CLASSES, ORDERS, AND SUB-ORDERS.

CLASSES AND SUB-CLASSES.

Classes and Sub-classes.	*Head.*	*Body.*	*Eyes.*	*Mouth furnished with*	*Respiration by means of*	*Locomotion effected by*	*Shell.*
I. Cephalopoda	Large	Often massive, enclosed in sack-like mantle ...	Sessile or pedunculate..	Two horny beaks... ...	Plume-like gills	Tentacular arms	Internal.
II. Pteropoda	More or less distinct..	Snail-like	None	Lingual armature... ...	Branchiæ external, or internal	Two lateral swimming discs ...	Internal, external, or absent.
III. Gasteropoda : Prosobranchiata. Opisthobranchiata. Pulmonata.	Distinct	" "	Stalked or sessile ...	" "	Gills or branchiæ	Creeping foot or disc	Mostly univalve, spiral, or conical.
IV. Scaphopoda	Rudimentary	Worm-like	None	Thread-like tentacles ...	Branchiæ (2)	" " "	Straight or curved tube.
V. Pelecypoda	None	Enclosed in a mantle ...	None or rudimentary...	Four fleshy leaflets ...	Gills only	A foot when not atrophied ...	Bivalve hinged.
VI. Brachiopoda	None	Inconspicuous, with two coiled ciliated worm-like arms	None	Long filaments	Mantle lobes, no branchiæ ...	Cilliæ, when young ; fixed in the adult.	Bivalve with perforated beak.

ORDERS AND SUB-ORDERS.

Orders and Sub-Orders.	*Distinguishing Characters.*			
I. ... Dibranchiata :	Gills, a single pair.			
... Octopoda...	" " ; arms eight	(Fam. i.	——	ii.)
... Decapoda	" " ; arms, ten	" iii.	——	v.)
... Tetrabranchiata	" two pairs	" vi.		)
II. ... Thecosomata	" within mantle cavity ; has an external shell	"	——	)
... Gymnosomata	" indistinct ; naked, no shell	"	——	)
III. Opisthobranchiata. Prosobranchiata. Pectinobranchiata	" in front of the heart ; shell spiral	"	——	)
Scutibranchiata	" " " " " " without anterior canal	" vii.	——	xxxix.)
Podopthalma	" " " " " " " " "	" xl.	——	l.)
Ediopthalma	" " " " " " " " "	" xl.	——	xlviii.)
Polyplacophora...	" " " " multivalve, 8 separate pieces	" xlix.	——	l.)
Nucleobranchiata	" " " " pelagic animals, swimming by means of fin-like lobes	"		li.)
Opisthobranchiata. Tectibranchiata	" behind the heart ; protected by a fold of the mantle	" —	——	—)
Nudibranchiata	" " " exposed or contractile into cavities in mantle	" lii.	——	lvii.)
Anthobranchiata	" " " plumose, arranged round the anus	" —	——	—)
Aiolobranchiata	" " " various, not arranged	" —	——	—)
Pulmonata. Stylomatophora	Terrestrial, four tentacles ; eyes at the end of superior pair of tentacles	" —	——	—)
Monotremata	Orifices of sexual organs united " " " "	" lviii.	——	lxiii.)
Ditremata	" " " widely separated " " "	" lviii.	——	lxiii.)
Basommatophora	Eyes at the base of the tentacles, which are flattened and triangular	" —	——	—)
Gehrydroptula	" " " " ; terrestrial ; teguments rugose	" lxiv.	——	lxviii.)
Hygrophila	" " " " ; fresh water ; " smooth	"		lxiv.)
Thalassophila	" " " " ; sea shores and brackish water ; head a flattened disc...	"		lxv.)
IV. ... ... Scaphopoda	Shell open at both ends ; straight or curved tube, not spiral	" lxvi.	——	lxvii.)
V. Siphonida	Having two well-developed muscular impressions	"	——	lxviii.)
Sinupalliata	Siphon long ; pallial impression with a sinus...	" lxix.	——	lxxxix.)
Integripalliata	" short " " simple, without sinus	" lxix.	——	lxxx.)
Asiphonida	No siphons ; pallial impression without a sinus	" lxxxi.	——	lxxxix.)
Homomyaria	Muscular impressions ; two equally distinct	" xc.	——	ci.)
Heteromyaria	" " " anterior small, posterior large	" xc.	——	xciii.)
Monomyaria	" " one posterior...	" xciv.	——	xcvi.)
VI. Arthropomata	Shell usually articulated with hinge teeth ; arms generally supported by an internal shelly process	" xcvii.	——	ci.)
Lyopomata	Shell not usually articulated with hinge teeth ; arms free, not supported by an internal shelly process	" —		cii.)

1 Ranella *elegans* Frog shell

2 Fusus *colus*

3 Fleurotoma *Babylonica* Tower of Babel

4 Mitra *plicaria*

5 Buccinum *undatum* Whelk

6 Nassa *reticulata* Dog whelk

7 Phasianella *australis* Pheasant

8 Scalaria *pretiosa* Wentle trap

9 Turbo *chrysostomus*

10 Elenchus *iris*

11 Trochus *viridatus*

12 Solarium *perspectivum* Stair case shell

13 Sigaretus *haliotoides*

14 Naticella *porcellana* Boat shell

15 *fornicata* Slipper shell

16 Natica *mille punctata*

17 Amphipeplea *glutinosa*

18 Valvata *piscinalis*

19 Rotella *vestaria*

20 Risella *acuminata*

21 Liotia *clathrata*

22 Planorbis *marginatus*

23 Haliotis *tuberculata*

24 Bulla *ampulla*

25

26 Terebra *pulvinatus*

27 Conus *nocturnus*

28 Erato *laevis*

29 Columbella *mercatoria*

30 Ancillaria *albisulcata*

31 Siliquaria *anguina*

32 Terebra *maculata* Auger shell

33 Cerithium *nodulosum*

34 Cerithiopsis *tuberculare*

35 Auricula *ismidia*

36 Succinea *putris*

37 Physa *fontinalis*

38 *polita* shell

39 Turritella *communis*

40 Chemnitzia *pagodissima*

41 Odostomia *plicata*

42 Rissoa *labiosa*

43 Bankivia *varians*

44 Cylindrella *cylindrus*

45 Truncatella *Montserati*

46 Dentalium *elephantinum*

47

48 Chiton *Cumingii*

49 Semele *reticulata*

50

51 Mvadora *brevis*

52 Trigonia *margaritacea*

53 Pecten *varius*

54 Mesodesma *donacia*

55 Pinna *pectinata*

56

57

58 Emarginula *reticulata*

59 Lissarella *Listeri*

60 Waldheimia

61 Solen *siliqua*

62

(ci.) Family OSTREIDÆ. (sp. 4.)

710	Ostrea *edulis*?	*Linne*	...	...	...	27
711	——— mordax.	*Gould*	...	...	...	27
712	——— rutupina.	*Jeff*	...	...	...	27
713	——— Angasi.	*Sow.*	...	..	...	27

MOLLUSCOIDA.

CLASS BRACHIOPODA.

(cii.) Family TEREBRATULIDÆ. (sp. 3.)

714	Waldheimia flavescens.	*Lam.*	...	...	...	27
715	Kraussia Lamarckiana.	Davidson	...	..	...	27
716	——— Atkinsoni.	*T.-Woods*	...	...	...	27

CORRIGENDA.

Page	7	FOR	Pelecypooa	READ	Pelecypoda.
"	38	"	Trochocochlea	"	Trochochlea.
"	48	"	Parnea	"	Barnea.
"	74	"	Arosalpinx	"	Urosalpinx.
"	76	"	Ancillari	"	Ancillaria.
"	"	"	Aesopus	"	Æsopus.
"	77	"	Cancellari	"	Cancellaria.
"	"	"	Cythara	"	Cithara.
"	78	"	Cassmaria	"	Casmaria.
"	79	"	Cirostrema	"	Cirsotrema.

DESCRIPTION OF A SECOND GANOID FISH FROM THE LOWER MESOZOIC SANDSTONES NEAR TINDER-BOX BAY.

By Messrs. R. M. Johnston and A. Morton.

On the 19th August, 1889, we had the pleasure of bringing under the notice of the members of this Society a new Ganoid Fish, from the Knocklofty sandstones, and named *Acrolepis Hamiltoni*, in honour of our worthy President, Sir Robert Hamilton. We have now the honour of giving a full description of a second species of the same genus recently discovered in a sandstone formation near Tinder-Box Bay, deemed to be nearly of the same geological horizon as the sandstones of Knocklofty.

Acrolepis Tasmanicus. *n. sp. Johnston and Morton.*

Body compressed, elongate, elliptical; length from snout to end of caudal fin, nearly 6 inches; length of head, 14 lines; length of body, $4\frac{1}{2}$ inches; snout projecting beyond lower jaw; greatest depth, 14 lines; least depth at peduncle, 5 lines. Dorsal fin somewhat falcate, composed of 48 to 50 slender rays (6 to a line) each one of which branches into two or three sub-divisions near extremities, and each one or two rays crossed distantly and in a curved manner by fine oblique ridges; base, $8\frac{3}{4}$ lines long, occupying a position nearer the tail than the snout, anterior end being 37 lines distant from snout, and the posterior end $45\frac{3}{4}$ lines; greatest length of dorsal (2nd, 3rd and 4th longest) same as base, $8\frac{3}{4}$ lines; the longer anterior rays curve over the anterior ones, which abruptly diminish in size, the posterior margin being thus irregularly vertical. Anal fin about the same size and composed of nearly the same number of rays as the dorsal fin, but its position is nearer the tail, the anterior portion commencing about 40 lines from the snout, and the posterior terminating about $48\frac{3}{4}$ lines distant. Ventral fin composed of about 18 fine rays, central, and well in advance of anal fin. Pectoral, imperfect, somewhat elongate, and consisting of numerous fine rays, which become subdivided towards extremities as in the dorsal fin. Rays of sub-caudal fin numerous, fine; fin elongate, nearly equal in length to the slightly elevated caudal extremity,* and forming with it a

* Length of caudal lobe (upper), 19 lines; length of sub-caudal fin, 14 lines; distance between extreme tips of caudal furcation, $15\frac{1}{2}$ lines.

bifurcation which is almost as symmetrical as the true homocercal forms; the rays on the lower margin of the true tail lobe form a narrow inconspicuous fringe. All the rays of caudal extremity are extremely fine, about 21 in the space of 12 lines, those of the sub-caudal fin are crossed repeatedly with curved, raised lines, composed of short, oblique ridges as in dorsal fin.

There are about 64 rows of small rhomboid scales or plates longitudinally arranged in an inclined and slightly curved dorso-ventral series. The transverse series varies considerably in number and depth; there being about 18 in oblique transverse series near peduncle, and about 35 near the shoulder; the scales are greatest in depth towards the lateral line, diminishing greatly as they approach dorsal and ventral margins; the base of each scale runs parallel nearly with others of the longitudinal series, and in a general view seem to divide the surface into fine parallel rows, which cut the more or less curved oblique transverse series into an oblique rhomboid pattern.

Each scale or plate is ornamented on the upper surface with the peculiar furcated raised linear ridges of the genus *Acrolepis*; these forked ridges seem to radiate from a point at the lower posterior angle and fork once or twice, upward and forward, in the direction of the anterior upper angle. This furcation reminds one of the forking neuration on the lobes of many species of ferns, and is very remarkable. Fortunately a portion of the fossil shows the under surface, and each scale of these series is characterised by a small tooth-like projection in the centre of each upper margin, with a corresponding raised socket on lower surface half the depth of scale, into which the tooth of each scale respectively of the lower series scale fits closely. Both socket and tooth have an angle corresponding to the direction of the transverse serial lines; the ornamentation of the scales forming the lateral line differs from all the others, as the fine furcate lines radiate more nearly from the centre of posterior margin, half of which curve upwards, and the other half downwards. As a rule the linear ridges are fewer in number relative to size of scale in the lateral line series.

This fine specimen was obtained from the Lower Mesozoic Sandstones near Tinder-Box Bay.* A group probably belonging nearly to the same geological horizon as the Knocklofty sandstones, Hobart, from which was obtained the

* In p. 149, "Johnston's Geology of Tasmania," these sandstones are described as "a series of reddish or yellow micaceous sandstones, sometimes of great thickness, often occur overlying the uppermost beds of the Upper Palæozoic Mudstones as at Tinder-Box Bay, Huon-road, and Waterworks Valley, near Hobart, with indistinct plant impression and silicified trunks of conifer. These sandstones apparently lie conformably and without stratigraphic break upon the uppermost beds of the Upper Marine series (Up. Pal.). Their position is assigned provisionally at the base of the Mesozoic rocks of Tasmania."—*(Johnston.)*

remains of *Acrolepis Hamiltoni*, recently described by us in the Proc. of the Royal Soc. of Tas. (1889). The species here described is much better preserved, and though closely allied to the former it is very distinct. The chief differences are the greater prolongation of the sub-caudal fin, giving greater symmetry to the caudal fork; the greater number of scales or plates in the lateral and transverse series; and also the relatively greater development of the vertical fins.

The ornamentation of the scales or plates, although of the same character, also appear to be much finer. The position and relative dimensions of fins also differ to some extent.

Good photographs have been taken of the two sections disclosed by the splitting of the rock in which the specimen was imbedded.

Along with these are given magnified views of the under and upper surface of the scales or plates, and also an enlarged view of the dorsal fin, showing the subdivided extremities of rays. The fine series of fulcral scales can be discerned forming a serration along the anterior margin of dorsal fin. There is a probability of a larger number of these interesting fish remains being obtained when operations in certain quarries are again carried out.

THE DISCOVERY AND OCCUPATION OF PORT DALRYMPLE.

BY JAMES BACKHOUSE WALKER.

1. The Discovery.

It is a fact, often forgotten, that an interval of a century and a half separated the discovery of the eastern coast of Australia from that of her western shores. The western coast was visited by the Dutch in the early part of the 17th century. It was not until the last half of the 18th that the eastern coast was first seen by European eyes. The discovery of Southern Tasmania belongs to the old period—to the days of the Dutch East India Company, and of Tasman's search for the Great South Land—to the days when New Holland had an evil reputation as the most forbidding and inhospitable country on the face of the earth. The discovery of our northern coast was one of the last of the modern epoch, when English navigators had laid open to the world the rich promise of the fertile lands of Eastern Australia, and when the first of the great English southern colonies had already been planted at Port Jackson.

A short sketch of the exploration of the Straits, and particularly Port Dalrymple, although it may traverse some ground already touched upon in former papers, may prove of interest as an introduction to the story of the settlement of Northern Tasmania. Such a sketch will serve to bring into due prominence the achievements of two men, whose names should be held in honour by every Tasmanian, as practically the discoverers of our island home and the pioneers who opened it for English colonisation. These two men were George Bass and Matthew Flinders.

I trust, therefore, that my readers will forgive my detaining them for a time from the settlement of Port Dalrymple by a prefatory history of the events which led to its discovery.

The existence of a great southern continent surrounding the antarctic pole and pushing itself northward far into the Pacific Ocean was a fixed belief of the old geographers. The hope of discovering such a continent

prompted not only the voyage of Abel Tasman towards the unknown South Land in 1642, when he discovered the southern coast of Van Diemen's Land, but many another expedition of the old navigators. As is well known, Captain Cook's first voyage in the *Endeavour*, in 1768, was undertaken for the purpose of observing the transit of Venus from a station in the South Seas. But when the observations had been made, Cook, in accordance with his instructions, headed the *Endeavour* from Tahiti to the far south, to make one more effort to solve the old geographical problem. After reaching lat. 40° S. without seeing any sign of land, he turned north and then west until he sighted what he at first took for the long-sought Terra Australis Incognita. It is scarcely necessary to say that this was the east coast of New Zealand. After circumnavigating the islands, in March, 1770, the question arose as to the homeward route. Cook himself had a strong desire to return by Cape Horn in order finally to determine whether there was or was not a continent in that direction. As, however, winter was approaching, it was thought inadvisable to venture into the stormy seas of those high latitudes. It was resolved, therefore, to return by the East Indies, and with this view to sail westward until they should fall in with the undiscovered east coast of New Holland, and then follow that coast to its northern extremity. The *Endeavour* took her departure from Cape Farewell, and on 19th April, 1770, sighted land at Point Hicks, about 60 miles westward of Cape Howe. Cook had expected to see the coast of Tasman's Van Diemen's Land to the south, and from the sudden falling of the sea concluded that it was not far off, but was not able to determine whether it was joined to New Holland or not. From Point Hicks he sailed north, exploring the whole length of the eastern coast, which he named New South Wales, until he reached its northern extremity at Cape York, and returned home by Torres Straits.

Cook's First Voyage, ii., 282.

Ibid., ii., 433.

Ibid., ii., 483.

Two years later, Cook sailed on his second voyage in the *Resolution*. He was accompanied by the *Adventure*, commanded by Capt. Tobias Furneaux. The ships were separated in a fog in 50° S. lat., between the Cape and New Zealand, and Furneaux shaped his course for the land marked on the charts as Van Diemen's Land, which he sighted on 5th March, 1773. After a short stay he sailed out of Adventure Bay with the intention of exploring the east coast as far as Point Hicks, Cook's most southern point, in order to discover whether the coast of

Van Diemen's Land was joined to that of New Holland. The *Adventure* sailed northwards till land was lost sight of a little to the north of the Furneaux Group, but continuing a northerly course Furneaux saw, or fancied he saw, land again in about lat. 39°. Here the soundings indicated the presence of shoals, and thinking the navigation too dangerous, he stood away for New Zealand. His conclusion is thus expressed:—"It is my opinion that there is no strait between New Holland and Van Diemen's Land, but a very deep bay."

Cook's Second Voyage, i., 115.

No further exploration in that direction took place before the settlement of Port Jackson in 1788, and for years subsequently the resources of the new colony were too limited to allow of more than boat expeditions to short distances from the Sydney Heads.

In June 1797, however, the wreck of a vessel named the *Sydney Cove*, on Cape Barren Island in the Furneaux Group, led to the despatch of the colonial schooner *Francis* to the scene of the wreck. The trips of the *Francis* not only extended geographical knowledge, but aroused a keen interest in the locality, as the seat of a most lucrative seal fishery.

Flinders' Voyage, Intro. 104.
Hunter to Portland, 6 July, 1797.

Just at this time H. M. S. *Reliance* arrived at Port Jackson from the Cape of Good Hope, with a cargo of cattle. She was in a very leaky condition, and had to be detained for extensive repairs. Amongst her officers were two eager and adventurous spirits, her Second Lieut., Matthew Flinders and her Surgeon, George Bass. They were both young—Flinders was 23—both ardent and full of zeal for exploration. On a previous voyage of the *Reliance* they had made a daring expedition down the coast in a boat only 8 feet long, and Bass had travelled inland to try to cross the Blue Mountains. On this occasion Flinders could not leave his ship, but Bass, tired of inaction, prevailed on Governor Hunter to lend him a whaleboat for a more extended voyage. The Governor gave him a boat, six weeks' provisions, and a crew of six seamen from the King's ships. In this whaleboat Bass made his way down the coast, examining the inlets and harbours, and battling with head winds and gales, for a distance of more than 600 miles. Rounding Cape Howe, and passing Cook's furthest point (Cape Hicks), he sighted the high land afterwards known as Wilson's Promontory, but the contrary winds preventing him from reaching it, he stood across for the Furneaux Islands, where he hoped to replenish his stock of provisions. The wind, however, now drove him to the south-west, and as

26 June, 1797, Collins' New South Wales, ii., 318.

Flinders' Voyage, Intro., 106.

the gale and sea increased, the water rushed in fast through the boat's side, and he was obliged to go on the other tack. After a time of considerable danger he once more reached the Promontory, this time on the west side, and proceeding along the coast, discovered and entered Western Port. He was detained in the Port for a fortnight by contrary gales, and as the seventh week of absence from Port Jackson had expired, want of provisions forced him very reluctantly to turn the boat's head homeward. On his way back he examined Wilson's Promontory, and came to the conclusion from various indications that there must be a strait between Van Diemen's Land and the mainland. He found that the flood tide swept westward past the Promontory at the rate of two or three miles an hour, the ebb setting to the eastward. "Whenever it shall be decided," he says in his journal, "that the opening between this and Van Diemen's Land is a *strait*, this rapidity of tide, and the long south-west swell that seems to be continually rolling in upon the coast to the westward, will then be accounted for." Strong contrary gales delayed Bass on his homeward voyage, and it was not until after an absence of 12 weeks, during a great part of which he and his crew had subsisted chiefly on mutton-birds, that he returned to Port Jackson, and reported his discoveries to Governor Hunter.

Flinders' Voyage, Intro., 117.

1 March, 1798. The Governor, in his despatch to the Duke of Portland, says that Bass "found an open ocean westward, and, by the mountainous sea which rolled from that quarter, and no land discoverable in that direction, we have much reason to conclude that there is an open strait through, between the latitude of 39° and 40° 12′ S., a circumstance which, from many observations made upon tides and currents, I had long conjectured . . . I presume it will appear that the land called Van Diemen's, and generally supposed to be the southern promontory of this colony, is a group of islands separated from its southern coast by a strait, which it is probable may not be of narrow limits, but may perhaps be divided into two or more channels by the islands near that on which the *Sydney Cove* was wrecked."

Flinders' Voyage, Intro., 120.

During Bass' absence in the whaleboat the *Francis* was again sent to the wreck, and this time Flinders accompanied her. The schooner went as far south as the entrance of Banks' Strait, and Flinders got his first sight

Ibid., 126.

of the north coast of Van Diemen's Land. The smoke rising from the land showed that there were inhabitants

on it, and as there were none on the adjoining islands, Flinders was shaken in his belief in the existence of a strait, for he could not understand how, unless by a connecting isthmus, men could have reached the more distant Van Diemen's Land and yet failed to have attained the intervening islands, more especially as those islands were so abundantly supplied with birds and other food.

When Flinders met Bass in Sydney and heard of his observations at Wilson's Promontory, he declared that there wanted no other proof of the existence of a strait than that of sailing positively through it; and this the two friends now anxiously waited for an opportunity to do. Their professional duties, however, delayed the execution of the project, but six months later when the *Reliance* returned from her voyage to Norfolk Island, Flinders explained his views to Governor Hunter, and the Governor gave him the *Norfolk*, a sloop of 25 tons, with a crew of eight volunteers, to attempt the circumnavigation of Van Diemen's Land. This voyage was briefly mentioned in a former paper, and it is not now necessary to follow it in detail, except so far as concerns our immediate subject, the discovery of Port Dalrymple.

Flinders' Voyage, Intro., 138.

On the 7th October 1798, Flinders and Bass sailed in their tiny vessel on their now famous voyage. Their first point was Cape Barren Island, and thence they sailed through Banks' Strait and proceeded along the north coast of Tasmania.

Ibid., 152.

On the 3rd November, at two o'clock in the afternoon, Flinders saw with great interest indications of an opening in the land, and bore up for it. The vessel advanced rapidly with the flood tide, and, rounding a low head, entered a broad inlet. Sailing up this inlet some three miles, they passed a low green island, when suddenly the sloop grounded. Fortunately the ground was soft, the strong flood dragged the sloop over into deep water, and drove her rapidly onward till the harbour suddenly expanded into a broad and beautiful basin, on which swam numbers of black swans, duck, and wild fowl. Its shores were broken into points and projections, covered with wood and grass down to the water's edge,—a strong contrast to the rocky and sterile banks observed in sailing up Port Jackson. There appeared to be three arms or rivers discharging themselves into this extensive basin, and, as evening was coming on, the sloop was anchored near to the mouth of the western arm. Flinders was greatly pleased with his discovery, to which Governor Hunter gave the name of

Port Dalrymple, in compliment to Alexander Dalrymple, the well known Hydrographer to the Admiralty. He employed 16 days in examining the place, explored Western and Middle Arms, worked his way up Whirlpool Reach, and got as far as Shoal Point and Crescent Shore, when, although he believed that half the river was still unexplored, the limited time allowed him compelled his return. The *Norfolk* took her departure from Low Head, and, sailing along the north coast, rounded Cape Grim, her commander finally settling the problem of the insularity of Van Diemen's Land by his circumnavigation.

The importance of the discovery was at once recognised in England; and early in 1800 the *Lady Nelson*, a brig of 60 tons, was fitted out and despatched under Lieut. Grant to examine the new strait. It was, however, left to Flinders himself in the *Investigator* two years later, to complete his own work by making the first reliable survey of its northern shores.

As we have already seen, the discovery of Bass Strait, and the possible colour it might give to French claims to the island, were among the causes which prompted King's hasty occupation of the Derwent by Bowen in 1803; and it was owing to King's urgent representations of the importance of forming settlements in the Straits to assist the seal fisheries and anticipate the French that Governor Collins' expedition was despatched to Port Phillip. When Governor Collins found his position at Port Phillip untenable, he was doubtful whether he should not remove his people to Port Dalrymple rather than to the Derwent. Governor King was also, in the first instance, strongly in favour of the northern locality, considering it more advantageously situated for the principal settlement in Van Diemen's Land, chiefly on account of the protection it would afford to English sealers in the Straits from the attacks of American interlopers. His only doubt was whether the soil was as good as that on the Derwent, and whether the entrance to the port was not too dangerous. To enable Governor Collins to satisfy himself on these points, he sent the schooner *Francis* to Port Phillip to serve as a surveying vessel. She was in a very leaky condition, and though they tried to patch her up at Port Phillip, and sent her, with William Collins, Clark, the agricultural superintendent, and Humphreys, the mineralogist, to make an examination of Port Dalrymple, she proved so unseaworthy that William Collins had to send her back to

King's Despatch, 21 May, 1802.

King to Collins, 26 Nov., 1803.

King to Woodriffe, 26 Nov., 1803.

Collins to King, 27 Jan., 1804.

Sydney and complete his voyage in the *Lady Nelson*, which he fell in with at Kent's Group.

The *Lady Nelson* entered Port Dalrymple on New Year's Day 1804. William Collins immediately proceeded with his examination. The *Lady Nelson* anchored above Upper Island (now Pig Island), and from thence the examination of the yet unvisited portion of the river was made in a boat. William Collins was delighted with the appearance of the country about the present site of Launceston, diversified with hill and plain, with good land both for pasture and agriculture. He went some distance up the Main River (North Esk) and found excellent land. Then he entered the Cataract Gorge. Grand as its towering rocks are now, the Gorge in its natural state, when clothed with the wild beauty of its native bush, and full of wild fowl, must have been magnificent. William Collins says of it: "The beauty of the scene is probably not surpassed in the world. The great waterfall or cataract is most likely one of the greatest sources of this beautiful river, every part of which abounds with swans, ducks, and other kinds of wild fowl. On the whole I think the River Dalrymple possesses a number of local advantages requisite for a settlement." Collins' Report, January, 1804. Clark's Report.

Collins had been 18 days in Port Dalrymple, and was anxious to get back to the Lieutenant-Governor with his good news. A fair wind carried the *Lady Nelson* across the Straits in two days, and on the 21st January Lieutenant Symons brought his ship to an anchor off the Camp, inside Port Phillip Heads. The Camp was a scene of busy activity, and when Wm. Collins landed to present his report, he found that the Lieutenant-Governor had at last made up his hesitating mind, and that the establishment was on the point of sailing to the Derwent. It so happened that Governor King had heard such a bad account from the captain of a schooner which had touched at Port Dalrymple for water, who painted such a picture of the dangers of the entrance and the hostile attitude of the blacks, that he had written advising Collins to give up all idea of the northern port. The Lieutenant-Governor, therefore, had the satisfaction before sailing of having his superior officer's approval of his final choice. Collins to King, 28 Feb., 1804. King to Collins, 30 Dec., 1803.

The reports of the explorers had now lost their immediate interest, and the Lieutenant-Governor forwarded them to King with the despatch announcing his departure. Collins to King, 27 Jan., 1804.

2.—THE OCCUPATION OF THE TAMAR.

Possibly Governor King, if left to himself, would have been contented, at least for the time, with the establishment of the Colony at the Derwent as a sufficient safeguard against French designs. But the apprehensions of the Home Government had been thoroughly aroused by the Governor's despatches pressing the urgent necessity of occupying certain points in Bass Straits and Van Diemen's Land to prevent the probable intrusion of French claims to the territory. It was the consideration of these despatches which had led to the writing of the Minute of December, 1802, quoted in a former paper, and to the sending of Governor Collins to Port Phillip with instructions to place a post on King's Island also. The Cabinet, however, was not yet satisfied with the precautions taken, and six months later Lord Hobart
24 June, 1803. addressed a despatch* (24th June, 1803, p. 429) to Governor King, in the following terms :—

"It appears to be advisable that a part of the establishment now at Norfolk Island should be removed, together with a proportion of the settlers and convicts, to Port Dalrymple, the advantageous position of which, upon the *southern* coast of Van Diemen's Land, and near the *eastern* entrance of Bass' Streights, renders it, in a political view, peculiarly necessary that a settlement should be formed there, and as far as the reports of those who have visited that coast can be depended upon, it is strongly recommended by the nature of the soil and the goodness of the climate."

The despatch proceeded to designate Lieutenant-Colonel Wm. Paterson of the New South Wales Corps, Lieutenant-Governor under Governor King, as the Administrator of the new Colony, at a salary of £250 a year.

Lord Hobart's despatch was very perplexing to King. The direction to occupy Port Dalrymple was too positive to be disregarded, and yet the grotesquely inaccurate description of Port Dalrymple as on the *southern*† coast of Van Diemen's Land, and near the *eastern* entrance of Bass Straits, introduced an element of uncertainty that

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* As an instance of the roundabout way in which even important Government Despatches reached the Colony in those days, it may be m entioned that Lord Hobart's despatch was landed at Norfolk Island by the *Adornis* whaler, and brought thence to Port Jackson by the *Alexander* whaler.

† It does not seem to have struck King that "southern" was probably merely a clerical error for "northern." In fact, this is the only possible explanation.

threw him into a difficulty as to his course of action. It was probable that Lord Hobart's directions were the result of a despatch of his own, dated 23rd November 1802, in which he had strongly urged a settlement at Storm Bay Passage, Port Phillip, or King's Island, to counteract any intention of the French intruding a claim within the limits of his government. But if so, it might be "respectfully presumed" that a mistake had been made in naming Port Dalrymple as on the south coast of Van Diemen's Land, and then the inference was that Storm Bay Passage was really intended. If this construction were right, then Colonel Collins's removal to the Derwent had anticipated the Minister's wishes. Furthermore, as Lord Hobart when writing had supposed Port Phillip to be already occupied by Collins, would his commands be best fulfilled by settling Port Dalrymple or re-settling Port Phillip? Or, if the despatch were literally obeyed, and Port Dalrymple occupied, would it not be advisable to send also a small post to Port Phillip or Western Port?

Opinion of Officers, 18 May, 1804.

The Governor propounded these questions to his principal officers, Lieutenant-Governor Colonel Paterson and Major Johnston of the New South Wales Corps, for their consideration and advice. They were unanimously of opinion that the commands of the Secretary of State to occupy Port Dalrymple, "with a political view," were too explicit and peremptory to admit of hesitation, and that they must be immediately carried into effect. They thought that the north side of the Straits should also be occupied, and a post established either at Port Phillip or Western Port, whichever might be found the more eligible situation. They recommended that Colonel Paterson should forthwith be despatched to Port Dalrymple with a small establishment, and a guard of not less than 20 soldiers.

King to Hobart, 15 May, 1804.

Having thus settled his course of action, the Governor lost no time in taking steps to send a force to occupy the post pending the transference of the colonists from Norfolk Island. The armed colonial cutter *Integrity*, 56 tons, was at once fitted for sea, and a small private vessel of 25 tons, called the *Contest*, was chartered to assist. The two ships were to take 20 convicts and a force of 34 soldiers, in all 56 persons. On the morning of the 7th June the New South Wales Corps was drawn up on the Government wharf as a guard of honor, and Lieutenant-Governor Paterson embarked in the pinnace to go on board his vessel. The pinnace left the

King to Hobart, 14 Aug., 1804.

Sydney Gazette, 10 June, 1804.

wharf, the battery fired a salute, and, to quote the reporter of the *Sydney Gazette*, "the most animated acclamations issued from the shore" as the new Lieutenant-Governor set out to found another British Colony—or rather to attempt to found it—for the same fate which befell the first attempt to found the Derwent Settlement attended that to the Tamar. It was now the depth of winter, and storms such as had driven back Lieutenant Bowen on his attempt to reach the Derwent just 12 months before met the ships at the entrance to Bass Straits. The *Integrity*, on rounding Cape Howe, battled in vain against the strong westerly winds which prevailed in the Straits, and had to put back to Port Jackson, which she reached on 21st June,* her passengers all ill in consequence of being battened down in the hold. The *Contest*, after beating about for a month, had to follow her consort's example. King was much disappointed, and made offers to the masters of two East India Company's ships then in harbour to take Paterson and his people to their destination, offers which their charter parties prevented them from accepting. There was therefore no alternative but to delay the expedition until the approach of spring, when H.M.S. *Buffalo* would be available for the service required.

King to Hobart, 14 Aug. 1804.

Paterson to King, 27 Sept., 1804.

During the interval between the return of the *Integrity* and the departure of the *Buffalo* a question of some difficulty arose respecting Paterson's relations to the Lieut.-Governor at the Derwent. Colonel Collins claimed that his appointment as Lieut.-Governor extended to the whole of Van Diemen's Land, that the northern settlement was therefore within his jurisdiction, and Paterson under his command. This claim Paterson wholly repudiated. He contended that he had received an appointment from the King as Lieut.-Governor of Port Dalrymple at a time when Collins was supposed to be at Port Phillip, that consequently his command was *wholly* independent of Collins, and he absolutely refused to tolerate any interference by the Lieut.-Governor at the Derwent with him or his settlement. Governor King admitted the cogency of Paterson's argument, and issued

23 Sept., 1804.

a General Order dividing the island into two independent governments, to be known respectively as the Counties of Buckingham and Cornwall, the dividing line to be the 42nd parallel of south latitude, each government to be

* Paterson in his despatch to Lord Camden, 14th November 1805, says he arrived in Port Jackson 17th June 1804, but this is probably an error.

subordinate only to himself as Governor-in-Chief of New South Wales and its dependencies.

Governor King's instructions to the new Lieut.-Governor present curious matter for study. We may pass over the usual directions as to the treatment of the aborigines, the investigation of the products of the country, the care of clothing, stores, and live stock, the oversight of the convicts, the regulations for the occupation of lands and their cultivation, religious worship, and so forth. But there are other features in the instructions which present a very striking contrast to what would in these days be thought proper to inculcate on the founder of a new colony. It must never be forgotten that these early establishments were not colonies at all in the modern sense, but military posts, established for political purposes, in which a limited number of convicts were utilised to provide the labour necessary for their maintenance. Instead, therefore, of encouraging trade and settlement, every possible precaution was taken to ensure the most complete isolation. This had the double object of keeping out foreign intruders and guarding against the escape of the convicts. Paterson was expressly enjoined to take particular care that all communication with the East India Company's possessions, with China, or with the islands visited by any European nation should be rigorously interdicted, or only allowed on the special authorisation of the Indian Government. No craft of any sort was to be built by any private person without a written licence from the Governor in Sydney. No intercourse was to be permitted between persons arriving in any vessel and the inhabitants of the settlement without the Lieut.-Governor's special permission. The American séalers who had given so much trouble to King had been building vessels from the wrecks of the *Sydney Cove* and other ships. These, if met with, were to be seized by putting the King's mark upon them. The introduction and sale of spirits by private persons was prohibited, and any which were introduced were to be seized and destroyed.

Instructions to Paterson, 1 June, 1804.

By the end of September H.M.S. *Buffalo* was fitted and ready for sea. The armed tender *Lady Nelson* and the Colonial schooners *Francis* and *Integrity* were to accompany her, and assist in conveying the people and stores to the new colony. Paterson's establishment consisted of Dr. Jacob Mountgarrett (who had come up with Lt. Bowen in the *Ocean* on 24 Aug., and on leaving Risdon had received the appointment of Surgeon);

General order, 22 Sept., 1804. *Sydney Gazette*, 14 & 30 Sept., 1804.

King to Hobart, 20 Dec., 1804.

King to Paterson, 11 Aug., 1804. King to Hobart, 20 Dec., 1804.

Mr. Alexr. Riley, Storekeeper, at a salary of 5*s.* per day; Capt. Anthony Fenn Kemp, Ensigns Hugh Piper and Anderson, 64 non-commissioned officers and privates of the N. S. Wales Corps, and 74 convicts. One settler, James Hill, accompanied the party, and possibly another. In all there were some 146 persons all told. The troops were embarked on Wednesday, 3rd October,—the music of the band, says our reporter of the *Sydney Gazette*, being "only interrupted by reiterated peals of acclamation from the spectators." On Sunday, October 14th, the Lieut.-Governor embarked from the Government wharf, under a salute of 11 guns from the battery, the band of the N. S. Wales Corps playing "God save the King" and "Rule Britannia." Governor King and a number of ladies and officers accompanied him on board the *Buffalo*, which saluted with 11 guns. The little squadron got clear of the Heads the next forenoon. The ships had a very rough voyage down, and a succession of heavy gales separated them. Most of the live stock died; and it was not until the 28th—a fortnight after leaving Port Jackson—that the *Buffalo* reached Eastern Cove, Kent's Group, where she found the *Francis*. Here she lay at anchor for 6 days, while it blew a strong gale from the westward. On the 3rd November the ships left their anchorage, and next morning the *Buffalo* made the entrance of Port Dalrymple. None of her consorts were in sight to try the channel for the larger vessel; and Captain Kent, with many misgivings, determined to make the venture; for he says, in his report to Governor King, "I saw little probability of the Settlement ever being formed unless some risk was run. I therefore bore up, in dark cloudy weather, blowing strong at north-west right on shore, for a harbour little—very little—known, hoping, should any accident happen to the ship, I might meet with every consideration for my zeal." After what he had heard of the strength of the tides, he was surprised to find it running only $1\frac{1}{4}$ miles per hour, and avers "that a common four-oared jolly-boat, rowed ill, could always, even in the height of the springs, head the tide between Green Island and Outer Cove, as it never exceeded 3 miles an hour." The night coming on, the ship came to an anchor below Green Island. It blew very hard in the night, and harder in the morning, the anchor came home and the ship drove on shore on the eastern shoals. Here she lay beating for three days; but the *Integrity*, Acting Lieut. Robbins, coming in, they lightened the ship of

Sydney Gazette.

Kent's Report, 28 Nov., 1804.

part of her cargo; and on the 4th day, after great exertions, she was got off, fortunately without damage, and came to an anchor in Outer Cove (George Town). Here the military, prisoners, and stores were landed, the tents were pitched, and on the 11th November possession was formally taken by hoisting H.M. Colours under a royal salute from the *Buffalo* and three volleys from the troops. Paterson to Camden, 14 Nov., 1805. Paterson to King, 23 Nov., 1804.

The other two ships did not arrive till the 21st, the *Lady Nelson* having suffered much damage from the storm, having had her decks swept, and having lost all her live stock. Before leaving, Captain Kent erected a flagstaff at Low Head, and other beacons for the guidance of vessels entering the port.

The day after taking possession (12th November), the camp was approached by a body of some 80 natives, under the lead of a chief. Presents were offered to the chief—a looking-glass, two handkerchiefs, and a tomahawk. Paterson says that the looking-glass puzzled them much, and that, like monkeys, on looking at it they put their hands behind it to feel if there was any one there. When they came to the boat they wanted to carry off everything they saw, but when made to understand that this could not be allowed they retired peaceably. Shortly afterwards, however, the blacks returned in greater force and made an attack on an outpost. A correspondent of the *Sydney Gazette* thus describes the incident:—"An interview took place with the natives, which began very amicably, but, unfortunately, their natural impetuosity has caused a temporary suspension of civilities, having attempted to throw a sergeant from a rock into the sea, and attacked his guard of two men, which compelled them to fire in their own defence." One black was killed, and another wounded in this affray. *Ibid.* 16 Dec., 1804.

The hurried landing at Outer Cove was necessitated by the accident to the *Buffalo*, and the pressing need of immediately unloading her. As there was a sufficient stream of water for present use, and about 100 acres of land that might do for cultivation, Paterson thought it best to keep his people at the spot where they had landed until he should have had time to explore the river. Captain Kemp, Dr. Mountgarrett, and Mr. Reilly, the storekeeper, were appointed the first magistrates of the settlement, Dr. Mountgarrett acting as Superintendent of Public Works. Mr. Thos. Massey was made chief constable, with three subordinates; two overseers were appointed, and Jas. Hill, the solitary settler, was Paterson to King, 26 Nov., 1804. General order, 19 Nov. 1804.

put in charge of the live stock. His duties were not onerous, for only a horse, four head of cattle, three sheep, and 15 swine had survived the storms of the passage. There was no chaplain, and as Paterson was at a loss for a person to perform Divine service, he induced Captain Kent to discharge from the *Buffalo* a Mr. Edward Main, who, we may presume, had some qualifications for the office, and who was thereupon installed to attend to the spiritual wants of the little community. The prisoners were set to work to erect temporary huts for themselves, which were plaeed clear of the camp on the opposite side of the creek, to prevent as far as possible communication with the troops. The prisoners worked hard and cheerfully from daylight to dark every day, and in a fortnight from the time of landing the huts were completed.

Paterson to King, 26 Nov., 1804.

The Governor's next care was to begin cultivation, for, with a salt meat diet, a plentiful supply of vegetables was most important to the health of his people. A gang of men was therefore set to work to break up ground. The means at hand for cultivation were limited; hardly any agricultural implements had been provided. The seeds had nearly all been destroyed by rats on the passage down, and most of the plants sent had died, though a few fruit trees and strawberry and hop plants had been saved. The Governor had to buy potatoes for seed from the master of the *Integrity*, as the authorities had not thought it worth while to send any for the use of the colony. Paterson's despatches show that in fitting out the expedition there had been the same extraordinary want of care and foresight in providing necessary things which seems to have been characteristic of official preparations for all these early settlements. He complains to Governor King that the prisoners were wholly destitute of shoes, and that he had been compelled to ask the purser of the *Buffalo* to let him have 100 pairs from the vessel's stock; while in such a vital matter as the supply of provisions, the quantity sent was so inadequate, in view of the difficulty and uncertainty of obtaining timely aid from head quarters, that he had thought it necessary to supplement his stock with salt meat from the *Buffalo's* stores.

Ibid.

The Lieut.-Governor had already made some short excursions from Outer Cove, and Captain Kent, of the *Buffalo*, had examined Western Arm, where he had found good streams of water, land fit for cultivation, and good timber; and from his rep rt Paterson thought

that it appeared to be the most eligible situation for the seat of government. It had taken him three weeks to get his people fairly settled at Outer Cove, and he was now free to go up the river and thoroughly examine the country. On the 28th November, therefore, he went on board the *Lady Nelson*. He took with him Surgeon Mountgarrett; with Ensign Piper, and a corporal and 3 privates of the N. S. Wales Corps, as a guard. They ascended the river, making observations of the country and soil as they went, till they arrived at the junction of the two rivers forming the present port of Launceston; and here the vessel came to anchor. Paterson was greatly pleased with the park-like country on the present site of Launceston, and considered it better pasture land than the Seven Hills, near Parramatta. The party now proceeded up the main river (now North Esk) in the ship's boat and the Governor's wherry. The journal notes the rich plains on the river banks; and further on (near St. Leonard's) the beautiful rising ground to the left, the green hills covered to the top with trees, and on the other side of the river—which was about 20 yards wide—the plain with stately gums, great wattles 60 to 80 feet high, and dense scrub. They pushed on with difficulty, the river being blocked with drift-wood and fallen trees, and various rapids giving them much trouble, until they reached a point—apparently about the White Hills—above which they found it impossible to take the boat. Here they pitched their tent on a rising ground, and looked with delight over the rich plains, or rather meadows, covered with luxuriant herbs and pasture, and waiting for the plough. Paterson says, "From my tent there is an extent which is seen in one view of nearly three miles in length and at places one in breadth, along the banks of the river, where thousands of acres may be ploughed without falling a tree. These plains extend upwards of 10 miles along the winding banks, and everywhere equally fertile." He found good clay for bricks, abundant timber for building, reeds for thatching, with everything necessary for agricultural settlement, and considered the country superior to any yet discovered. They made excursions on foot some miles further up the river; and then, "having ascertained to a certainty that the country in general can hardly be equalled either for agricultural or pasture land," they made their way back down the river, and reached the *Lady Nelson* near the Cataract, after an absence of four days. Paterson describes the Cataract Gorge, with its stupendous

Paterson's Journal, 506.

Ibid., 515.

columns of basalt rising one above another to over 500 feet in height, as picturesque beyond description,—the effect being heightened by the number of black swans, unable to fly, in the smooth water close to the fall. Paterson named the Cataract River the South Esk; and, to the main river, including what is now known as the North Esk, he gave the name of the Tamar, out of compliment to Governor King, whose birthplace was on the English stream of that name. After an absence of a fortnight, the *Lady Nelson* got back to Western Arm, and entered that shallow inlet. Here Paterson landed to examine, for the second time, a piece of land at the head of the Arm, between two streams a quarter of a mile apart, and which he had named Kent's Burn and M'Millan's Burn. He says, "On landing, the soil is very forbidding, being a hard whitish clay mixed with quartz; but towards the hills there are patches of excellent ground, and the finest timber I ever saw (gum and wattle). Boats, at high water, can come up close to either of the runs. After much labour and attention I have paid in examining every part of the river, I have seen none so advantageously situated for a permanent settlement as this, where there is an easy communication with vessels arriving in this port as well as with settlements higher up the river. These favourable circumstances have induced me to determine upon removing the principal part of my small military force, with most of the prisoners, and commence clearing ground and erecting the necessary buildings before the winter sets in."

Paterson's Journal, 525.

The question naturally arises, by what extraordinary perversity of reasoning did Paterson arrive at the conclusion that the miserable patch of land at the head of Western Arm was pre-eminently the best place for his chief settlement? He had just come back from a visit to the splendid site of Launceston and the fertile banks of the North Esk, which he described as superior to any country yet discovered either in Van Diemen's Land or New South Wales, and as possessing every possible advantage for a settlement, including approach to it by a fine river navigable for large ships. What induced him, then, after anxious thought, to pass this by, and deliberately make choice of a narrow strip of land which he describes as having a forbidding soil, and which was situated at the head of a shallow and muddy inlet not accessible even to boats except at high water? The explanation, I think, is to be found in the policy of the home

government. Founding a colony, according to modern ideas, means to open up the country as speedily as possible, to settle the lands with energetic cultivators who will develop the natural resources of the soil, to attract a population who will thrive themselves and advance the colony by the extension of an export trade. Nothing was further from the thoughts of the home authorities than any plan for colonising in this sense. New Holland was to be, not a colony, but a place for the reception of criminals,—a settlement to relieve the home country of the ever growing and overwhelming difficulty of disposing of her criminal population. The British Government not only did not encourage colonisation, they endeavoured as far as possible to prevent it, or at least to confine it within the narrowest limits, permitting it only in so far as it might be made to serve as an auxiliary to their sole object—the maintenance of a penal settlement at the smallest possible cost. The subordinate establishments at Port Phillip, the Derwent, Port Dalrymple, Newcastle, and other places were planted in the first instance as military posts, to prevent France establishing herself in spots where she might be able to harrass the great penal establishment at Port Jackson. The expeditions of Bowen, of Collins, and of Paterson were mainly precautionary measures, part of the military policy of England in her great struggle with France. Prisoners were a useful part of these early establishments, as providing labour which, by the erecting of buildings and cultivation of the soil, might make these posts as little burdensome as possible to the national exchequer. These outlying settlements, also, if favourably situated, might in course of time become valuable penal stations. Some of them, such as the Derwent and Port Dalrymple, would further serve the useful purpose of ports of refuge for the East India Company's vessels in the China trade, and form convenient posts for the protection of the whale and seal fisheries from American and other foreign intruders.

Bowen's choice of Risdon, and Collins' abandonment of Port Phillip when he could not find a suitable locality near the Heads, were not, as is too often supposed, the result of incapacity and blindness. They wanted to form a station, not to plant a colony—a station readily accessible from the sea—and the resources of the interior of the country were of little concern to them, so long as they could find in their immediate neighbourhood sufficient pasture for their cattle, and enough agricultural

land to yield a food supply for their people. It was, doubtless, considerations such as these which led Paterson deliberately to turn away from the fertile banks of the North Esk and fix his people on the little strip of forbidding soil at the head of Western Arm.

Paterson to King, 27 Dec., 1804.

The Lieut.-Governor gave the name of York Town to the spot he had chosen for his town. He marked out the ground for erecting dwellings, and set the prisoners to work to load the *Lady Nelson* and *Francis* with a portion of the stores and with two wooden houses which he had brought with him from Port Jackson. He detained the *Lady Nelson* until after the new year in order to assist in the removal from Outer Cove, and when she sailed for Port Jackson on the 11th January, 1805, she took some tons of the iron ore which he had found in great abundance in the neighbourhood of his settlement.

Sydney Gazette.

From this point it is difficult to trace the history of York Town from the official papers. Paterson's despatches present a great contrast to the careful and voluminous reports sent by Governor Collins from the Derwent. Collins could give interest even to an official document, and introduced into his despatches an amount of graphic detail which not only gives us a full history of events but enables us to reconstruct the actual condition of his colony. Paterson was neither so precise nor so picturesque as Collins; his official communications are meagre, and his carelessness in supplying regular and full returns brought upon him the censure of Governor Bligh. The Lieut.-Governor's deficiencies can, however, be partly supplied from the columns of the *Sydney Gazette*, which, during the year 1805, contained many letters giving information with regard to the new settlement at Port Dalrymple.

Sydney Gazette, 10 Mar., 1805.

In January or early in February, 1805, the schooner *Integrity* was despatched by Governor King to examine a port situated to the westward of the mouth of the Tamar—presumably Port Sorell—which had been discovered by Surgeon Mountgarrett and Ensign Piper, and by them named Supply River. On the 22nd she left, carrying a report that the country between the Supply River and York Town had been found so good that it was intended to give the first free settlers locations of land in that district. The buildings at York Town were rapidly approaching completion. The colony at Outer Cove was doing well, the gardens had flourished, and on the 18th January—ten weeks after the first landing—the Governor

and others who had cultivated small plots of ground had peas, French beans, potatoes, and turnips. Vegetables were plentiful, and it was fully expected that the cultivation of grain would be an equal success. Towards the end of March, H.M.S. *Buffalo* again sailed for the Tamar, carrying an additional military force, 50 prisoners—mostly from Norfolk Island—2 horses, 8 head of cattle, 135 sheep, and a quantity of stores. This made the total strength about 200 persons. Mrs. Paterson was a passenger by the *Buffalo*, and the transference of head-quarters to York Town was completed before the end of March.

Sydney Gazette, 24 Mar., 1805.

Paterson to King, 5 April, 1805.

By this time Paterson had received a welcome addition to his resources. Lord Hobart had, in 1803, directed Governor King to enter into an arrangement with Campbell & Co. of Sydney, to import cattle from India for the use of Collins's Port Phillip settlement. When Collins removed to the Derwent, King arranged with Campbell & Co. to supply these cattle to one or other of the Van Diemen's Land settlements. The directions as to the their final destination were given in a way sufficiently curious, and which illustrates the primitive methods in use in those early days. The master of the vessel bringing the stock, on his arrival at the entrance of Bass Strait, was to send a boat ashore at Sea Elephant Bay, King's Island, where he would find a shed, from the rafters of which a bottle would be suspended, and in the bottle he would find a letter with the Governor's directions as to the port at which the cattle were to be landed. The contract price was to be £25 per head for the cows landed, and £5 per head for the calves. 910 cows were put on board the ship *Sydney* at Calcutta. Of these 298 died on the passage; the remaining 612, with 10 calves, being safely landed at Port Dalrymple at the end of March. The cost to the Imperial Government of this shipment was £15,350.

Campbell to King, 19 May, 1804.

King to Camden, 30 April, 1805.

As York Town did not afford sufficient pasture for the stock, the Lieutenant-Governor had them landed at Outer Cove, where Ensign Piper was placed in charge of them. The change of climate and food, however, was so injurious to them that their numbers rapidly diminished, and they were removed to the less exposed western shore, where sheds were erected for their shelter. In spite of all care and the labour of a large number of men in providing them with fodder, the winter reduced them so much that the return of spring saw only 251 of the Bengal cows surviving. Paterson therefore had them removed, first to Point Rapid and then to the

Paterson to King, 14 Nov., 1805.

Ibid., 30 Dec., 1805.

plains on the North Esk, where they found better pasture and a more congenial climate. Although York Town was now the head quarters, Paterson still kept up an establishment at Outer Cove as his port and his depôt for stock. He also had a small post at the Low Head flagstaff and at Green Island, which formed his store depôt. This did not meet with the approval of the Governor at Sydney, who objected to the division of his forces, and thought they ought to be concentrated at his principal settlement.

Paterson's Journal, 528.

There is little more to tell respecting the York Town Settlement. After a few months' trial Paterson found the site so unsuitable that in March 1806, he moved his head-quarters to the banks of the North Esk—the present site of Launceston. A small establishment was, however, maintained in the old port for upwards of a year longer, and then York Town was finally abandoned.

For long years afterwards the whole district was deserted, save for a few scattered and insignificant holdings. Towards the year 1870 (I think) attention was directed to the working of the rich iron deposits in the neighbourhood of Western Arm, and large smelting works were erected at Ilfracombe. The enterprise proved a failure.

Though the iron industry had failed, gold was destined to restore the fortunes of the district. Gold was discovered in 1870 at Cabbage-tree Hill, in the vicinity of Middle Arm, and by the development of the Tasmania Mine a considerable population has been attracted, so that in the present year we have the town of Beaconsfield a prosperous mining centre, claiming to be the third town in the Colony, within less than five miles of the spot which Lieutenant-Governor Paterson designed to make the capital of northern Tasmania.

Anyone who has the curiosity to see the ruins of this early settlement may easily reach the spot from Beaconsfield. A rough bush-track, practicable for a chaise cart, winds in a north-westerly direction through miserably poor country, covered with gum forest and a heath-like scrub intermingled with the dwarf grass-tree. After travelling for about 5 miles along this track and crossing the Anderson's Creek of Paterson, we reach M'Millan's Burn, now known as Massey's Creek, and emerge from the bush. Between this creek and a creek on the north, (called by Paterson Kent's Burn, but now known as the York Town Rivulet), just at the head of the Western

Arm, is a cleared flat of indifferent land, 300 to 400 yards wide. This is the site of Paterson's settlement. On the banks of the northern creek are some fair grass paddocks; and immediately beyond rises an abrupt, almost precipitous, wooded ridge, to which Paterson gave the name of Mount Albany. From the side of this hill the flat on which York Town stood lies spread out below us. Two little wooden cottages or huts, surrounded by neglected orchards, are the only habitations. To the left stretch the shallow waters of Western Arm, fringed with extensive mud-flats which are bare at low water. The owner of one of the huts on the desolate clearing is an old man, the son of a man who came with Paterson's first establishment. He is ready to tell the visitor of blacks and bushrangers, and of the days when there was a Government House, and York Town was busy with soldiers and prisoners.

Ruins of the original Settlement there are none. The old inhabitant points to a hole, from which the foundations have been long ago removed, as the site of Government House, and to a clump of wattles as the spot where once stood Captain Kemp's house, the birthplace of the late Mr. George A. Kemp. This is all;—except that back in the bush, where the little valley widens, are a few mounds under the gum-trees, half hidden by the low scrub, and indicating neglected and forgotten graves.

REMARKS ON A RECENT PROPOSAL TO INTRODUCE OSTRICHES INTO TASMANIA.

By Jas. Andrew.

During last year a proposal was made to the Government to introduce Ostriches into Tasmania, following the example of what was done with some little success in the Continental Colonies of Australia and in New Zealand at a time when very large profits were made out of this industry in the Cape Colony and other South African States. The offer, however, was made subject to the financial safeguard of a Government guarantee, and failed to secure favourable consideration.

From observations of the habits of wild ostriches, and from some little experience of their management when domesticated, having owned birds myself, I venture to offer a few remarks on farming for feathers, and the possibility of such an industry being successfully carried out in Tasmania.

An observer of ostriches in their native state would imagine the task of bringing such birds under the subjection of man to be almost an impossibility. No wild creature of the plains is so difficult to approach, none are so timid or so fleet. The stratagems of natives or the well organised arrangements of professional hunters are required to ensure a successful chase. And yet their domestication has been comparatively easy, and now that their habits are well understood it is found that in confinement they can be bred and reared, and maintained as adult birds, with no appreciable loss of their natural characteristics.

Their chosen home is a waterless desert, with sparse and stunted vegetation, affording no shelter from the burning sun; their food small reptiles and animals, the young leaves and twigs of bushes, and the wiry grass and other small plants whose existence under such surroundings is always a mystery to travellers. The speed of the ostrich is a marvel of pace. Each stride, as has been verified by careful measurements, is from 22ft. to 28ft. One observer reports 30 strides of 12ft. each in ten seconds, or 26 miles per hour, which agrees with the estimate formed by Dr. Livingstone.

The male bird is an imposing creature, in height to the top of the head often 9ft. and even sometimes 10ft., thus exceeding any other existing species of aves. The neck is long and muscular, the head small, with a broad and depressed bill, eyes large and brilliant. The wings are hardly more than rudimentary, being useless for purposes of flight, the thighs

are exceedingly well developed, and are destitute of feathers, the legs and feet massive, the toes, two only in number, of unequal length. The body feathers in the male are deep black, the wing flights and tail feathers are, in strong contrast, pure white. The plumage of the female is a uniform brownish grey, but specimens are not infrequently met with having white wing and tail plumes, and I have seen domesticated birds of both sexes with spangled black or brown and white body feathers.

A peculiarity of an ostrich feather is that the quill is exactly in the centre of the webs instead of, as in the plumage of all other birds, more on one side than the other. This is accepted as the origin of their use as an emblem of justice in Egyptian hieroglyphics.

It appears that the geographical distribution of the ostrich was formerly much greater than at the present time, although even now its range is more extended than is generally supposed, including some parts of Asia, Arabia, and Northern and Southern Africa.

In a condition of nature ostriches are polygamous, and their nests, mere shallow depressions in the soil, are resorted to by several members of the same family, and in consequence the eggs they contain, laid at very varying intervals, are to be found at all stages of incubation. Contrary to a generally accepted belief the sun's rays are not depended upon to hatch out the chicks, the birds of both sexes taking turns of duty on the eggs. The hen bird lays every other day until some twenty or more are in the nest. The period of incubation is 42 days. The eggs are from 5 inches to 6 inches long, and 4 to 5 inches broad, weighing between 3 and 4 lbs., or of about 24 times the capacity of those of the common fowl; they vary in appearance in different countries, some being pitted all over with small dark coloured spots, others are a smooth creamy white, without blemish of any description, and resemble polished ivory. As an article of diet they are often of the greatest service, a large one, according to one writer, is said to furnish a meal for ten men. Hunters cook them in the shells placed on the embers of the camp fire, a hole knocked in the upper end, and the contents briskly beaten up with a forked stick during the operation. In puddings and custards they are frequently used by Ostrich farmers, and in this condition, as well as in the more primitive form, I have frequently had occasion to commend them as a welcome change in a very limited bill of fare. The shells, about 1/16th in. thick, are almost indispensable to the Bushmen of the Kalahari desert, for, filled with water, stores of them are buried for use on their return journeys from hunting expeditions or marauding forays, whilst pursuing parties, being unable to carry a sufficient supply, are unable to continue the chase.

Threaded on stout wire by which goods are suspended from the beams of store-houses, empty shells are an efficient precaution against injury by rats.

Prior to 1864, when modern experimental domestication commenced, the high prices ruling for feathers led to the indiscriminate slaughter of ostriches. In easily accessible districts they were soon exterminated, and there was occasion to fear that these interesting and valuable birds would soon become as extinct as their near connection, the Moa of New Zealand, and the enormous Æpyornis of Madagascar. But man's ingenuity and perseverance have counteracted the evil effects of his previous greed and destructiveness, and there is now no danger of so deplorable an event.

The author of the "Dominion of Man" shows that the settlers of South Africa are not the first Ostrich farmers, for in this, as in other instances, we find that the ancient Egyptians have been our predecessors. He states:—"On the monuments there are representations of ostriches which are under the dominion of man, and which are being handled in a manner which shows a thorough acquaintance with the character of the bird."

Rather less than thirty years ago the first attempt was made in the Cape Colony to keep ostriches in confinement with a view to profit. The feasibility of rearing their chickens artificially was soon demonstrated; the value of the new industry required no advertising; imitators of the original experimenters were numerous, and in a few years Ostrich farming was a firmly established resource of the Cape pastoralists. It was not necessary, however, to be a large landholder to commence operations, for breeding birds are always kept separate from the flock, each pair being enclosed in a camp or paddock of convenient size, varying in extent from five to forty acres, and chosen in a level locality, free from rocks, stumps, and holes. With rare exceptions domesticated birds are monogamous, but some difficulty often arises in inducing them to mate according to the desire of their owners. The hens are sometimes most capricious in their choice, whilst the males display absolute brutality towards unappreciated companions, and many changes are occasionally found necessary before satisfactory arrangements can be concluded. The breeding camps are enclosed by stone walls, thorn brush, or more frequently wire fences; and where a number of enclosures are together, the dividing fences must be double, with a space between of not less than 6ft. or 7ft., to prevent the male birds from fighting. A very slight enclosure suffices to confine ostriches at ordinary times, for they cannot step over a fence a yard high, but when frightened or enraged they rush blindly at any obstacle, and in consequence all enclosures must be secure.

During the nesting season the male is most pugnacious and may only be approached in safety with great precaution. He resents the intrusion of any visitors on his domain and proves a most formidable opponent. His mode of attack is by a series of kicks. The leg is thrown forwards and outwards until the foot, armed with a most formidable nail, is high in the air, it is then brought down with terrific force, serious enough to the unhappy human being or animal struck with the flat of the foot but much worse if caught and ripped by the toe. Instances are known of men being killed outright by a single kick, and I remember, whilst on a visit in the neighbourhood, that on a farm near Graaff Reinet a horse's back was broken by one such blow aimed at its rider. If attacked a man should never seek safety in flight ; a few yards and the bird is within striking distance and the worst consequences may result. The alternative is to lie flat on the ground and submit with as much resignation as possible to the inevitable and severe pummelling which it may be expected will be repeated at intervals until a means of escape presents itself, or the bird affords an opportunity of being caught by the neck, which if tightly held and kept down prevents much further mischief. Under such circumstances, however, I have known a bird with a badly calculated kick strike the back of its own head scattering the brains, a serious loss of valuable property to the farmer. It is, of course, an easy matter to break a bird's neck when in the position described, but at the time to which I refer the high price of birds prohibited such a mode of relief except under the most exceptionally dangerous circumstances. The early practice amongst farmers was to enter the camps protected with a long pole forked at the end. As the bird advanced his neck was received in the fork and his feet kept beyond striking distance; but as they soon learned to suddenly back out of the prongs and before a fresh defence could be arranged to rush the intruder, it has been the custom more recently to carry a small thorn bush at the end of a long staff, which, always kept at the level of the bird's eyes, proves a tolerably efficient protection. It is usual for two men to enter a camp together when any work has to be performed, one to act as guard.

Confined in such small enclosures ostriches require, of course, some artificial food; this generally consists of mealies, or Indian corn, and often the leaves of the prickly pear chopped into pieces. They are also furnished with a supply of pounded bones. It is usual to keep drinking water in the camps, but as to whether this is necessary opinions differ. Birds have been deprived of water for nine months, whilst those in an adjoining enclosure had an unlimited quantity, but there was no apparent difference in their condition or health.

As a first step towards domestic duty the male bird, in

confinement, scratches out a shallow depression in the ground, generally in some such unsuitable spot as the dry bed of an occasional water-course. The eggs vary to some extent in number, and on farms where natural nesting is preferred all over about twenty are removed.

There has been much difference of opinion as to the rival merits of leaving this process of hatching to the birds or saving them the duty by the use of incubators, but I am inclined to support the view that a larger percentage of chickens and stronger birds are secured by the former method. It is essential, however, that an incubator should be amongst the appliances of every ostrich farm for use in emergencies.

As in the wild state, the male performs an equal share of incubation with the female, who, being less conspicuous than her consort, remains on the eggs for the greater part of the day, the male sitting during the night, his turn of duty lasting from about four p.m. until early the next morning. At the proper hour the male grazes in the direction of the nest in an apparently indifferent manner until the hen, suddenly rising, runs some distance at a rapid pace, frequently changing her direction. At once he is on the eggs, and almost concealed, she having momentarily attracted the attention of onlookers. Much care is exercised by ostriches to conceal their nests, and it is surprising how inconspicuous the birds are when, surrounded by the low bushes of the veldt, they crouch over the eggs with their long necks extended on the ground.

It is not uncommon for one of the birds to refuse further duty at any stage of the hatching process, when the other, either male or female, may remain faithful to its instincts and, unaided, patiently complete the necessary period. The vitality of the embryo chick is remarkable. In my own experience I have in the early morning taken home eggs which had been exposed all night to a severe frost, and afterwards succeeded in hatching them in a box before the fire.

During natural incubation the eggs are liable to destruction by the many enemies of the ostrich, as are also the young birds for some time after hatching. Jackalls, baboons, hawks, and crows attack either eggs or chicks, whilst should an adult bird resent the appearance of a porcupine in its camp, it may be lamed for life by kicking against so efficiently armed an animal. It is no fiction that crows, unable to break and feast on the eggs by other means, pick up stones with their feet, and hovering perpendicularly over the nests, drop their missiles with destructive effect. They destroy tortoises in a somewhat similar manner: the reptile is itself raised into the air—a rock the target. What truth there may be in the assertion that a crow so encumbered cannot fly horizontally,

I am unable to say, but there can be no reason to doubt the many authorities who vouch for the above.

The young birds are at first about the size of domestic fowls, but in their markings resemble young partridges, with the peculiarity of having what appear like small porcupine quills mixed with the down on their bodies. If hatched naturally they must be removed from the camps within ten or fourteen days or they are liable to acquire wild habits prejudicial to discipline in their future artificial state of existence. For the first month or two the chicksare exceedingly susceptible to changes of temperature, they are carefully watched by day by the boy in charge (any male native of whatever age is a "boy") and they soon learn to know and respond to his warning cry. They are easily frightened, and at any alarm scatter in all directions, and after running a short distance, crouch, neck extended, on the ground, and so resemble their surroundings that an inexperienced eye might easily fail to detect them even if right in their midst. Dogs, from their liability to cause a panic amongst youngsters and annoyance to older birds, should never be seen on an ostrich farm. At night the chickens are housed in warm flannel-lined boxes placed in an artificially heated room. For a day or two after first seeing light they require little or no food, but make preparation for the serious business of life by taking in a supply of small pebbles to assist the digestive action of the gizzard. Their first sustenance consists almost exclusively of soft green stuff chopped into pieces of convenient size. Lucerne, rape, cabbages, etc., are the usual diet, with later, a liberal supplies of mealies (Indian corn), or they may be successfully reared on veldt which has been kept clear from other stock. At all times, however, young ostriches must be kept away from the plants of wild tobacco, which, if eaten, invariably prove fatal to them. The birds grow rapidly and in a month are as large as turkeys, and the down has disappeared, being replaced with rudimentary feathers. At six months old they require comparatively little attention, the head of the bird will now be as high as an ordinary man, and in a year nearly the full size is attained and the first crop of feathers is fully ready for cutting. A most amusing peculiarity of young birds is a tendency when let out from the kraal in the morning to dance wildly and rapidly in a circle, neck extended and wings opened, at first revolving slowly, afterwards with increasing pace until they gyrate in a most astonishing manner. Although adults in size at this age it is not for another two years or more that their reproductive instinct appears to be developed.

Feather cutting is presumably the most important operation on a farm. The process is by no means cruel, and entails far more discomfort to the men employed than to the

birds themselves. A small yard or enclosure is so closely packed with ostriches that they are quite unable to move and their only means of defence, by kicking, is prevented. A man can then go amongst them with impunity, and spreading in turn the wings of each bird with a small pair of self-opening garden nippers, he severs the quills of two or three feathers at a time, passing the plumes as cut to his assistant. The first row of the wing flights of the male bird, about 24 in number, are pure white, as also are the second and sometimes the third rows, but those with grey or brown edges are remarkably handsome, and all, even the small body feathers, are marketable. After being some time in the yards the birds becoming used to their surroundings peck persistently at any shining object, and frequently at the ears of the operators: all studs, bright metal buttons, etc., should be removed before commencing such work. One peck is a trifling circumstance, but many repetitions of it on the same spot occasion considerable pain: sore ears for some time afterwards has invariably been my experience after a day in the yards. In addition to this the birds swarm with vermin, which does not enhance the pleasure of the work. Sometimes it may be found impossible to get a male bird of savage disposition into the clipping pen, and then, and then only, is the practice of pulling the feathers resorted to, for he must be caught and held whenever a favourable opportunity presents itself. He may perhaps expose his neck to be seized and held fast over a fence, a second man can now approach from behind and pluck the feathers, returning to a place of safety with as much expedition as possible.

Most of the profit made in the earlier days of ostrich breeding was by the sale of young birds for stocking other farms. The prices realised were astonishing, and well paired mature birds could hardly be purchased except at prohibitory rates. In 1881 chickens, as soon as hatched, sold for £5 a-piece; at three months old, for £10; and at 12 months, for £20 or £30. At one sale thirteen lots of mated birds, some of which had commenced laying, realised from £125 to £220 per pair. These were from six to eighteen years of age. One exceptionally prolific pair were considered by their owner to have been worth quite £400 a year to him for several years in succession; for they reared four broods of chickens in thirteen months, all of which found a ready market at £10 per head. Feathers, of course, vary in value exceedingly, according to quality, and are subject to great fluctuations in price. In the halcyon days of this description of farming the best blood feathers, of which about 120 weigh 1lb., were worth from £40 to £60 per lb., or more than their weight in gold, and a domesticated adult bird yielded each year a crop worth nearly £20.

A peculiar blemish is often observed in ostrich feathers procured from tame birds, which is known as the "hunger streak." It appears, according to the authors of "Ostriches and Ostrich farming," as a line of imperfection across the web of each feather, chiefly in those of the wings, while on the shaft the mark may not only be seen but felt as a slightly projecting ridge. The injury from this cause is sometimes such as to occasion the feathers to break off." "It occurs most frequently in time of drought, when the birds are unable to procure their natural diet, and have to be fed on maize, or such other dry food as is most easily obtainable. This produces an unhealthy condition of skin, and experience has shown that the remedy lies in the cultivation of prickly confrey, which not only withstands droughts well, but furnishes the birds with excellent food well suited to their requirements.

Feathers require no preparation for sale except washing and careful classification. Of the different grades sorted for the London market those from wild birds rank first, then white tame feathers, the best only worth half as much as prime specimens of the former, followed by others known as feminas, byoks, boos, blacks, etc.

To preserve wild feathers from risk of injury, hunters and traders, during their rough and prolonged journeys in the interior of South Africa, used at one time to insert each valuable plume into a hollow reed. The end of the quill was first introduced, and by repeated tapping the whole feather gradually disappeared, the webs lying upright alongside the shaft. With the ends of such reeds securely sealed no harm could result.

There were only 80 tame ostriches in the Cape Colony in 1865, and the feathers exported weighed 17,522lbs., valued at £65,736, the whole of which, except 120lbs., were from wild birds. In 1875 the number domesticated was no less than 32,247, and the exports were valued at £304,933 for 49,969lbs. In 1882 exports reached the highest value they have ever yet attained, viz.: £1,093,989 for 253,954lbs., and since 1886, when the export was 288,568, valued only at £546,230, the yield has steadily decreased. The number of domesticated ostriches in the colony is now about 160,000. In twenty years the average price for all South African exports of feathers has fluctuated from 70s. to 110s. per lb.

It is evident, then, that the supply has exceeded the demand, the enormous profits made by the sale of young birds will never more be realised, and it is hardly to be expected that feathers will ever again be quoted at the old market rates. But there should still be substantial recompense to be earned in the country where they are indigenous by an ostrich farmer managing his property with skill and intelligence, and

in spite of a certain amount of risk attached to the industry, it should be equally as attractive as sheep farming. The danger of allowing the free removal of birds and eggs to other countries was long ago recognised by the Government of the Cape Colony, for, in 1883, they imposed an export duty of £100 on every bird, and £5 on each egg. Before this, however, several shipments of ostriches had been forwarded to India, California, the River Plate district, and to the Australian Colonies, and it has been made evident that feather farming may be followed with some amount of success in all these countries. In fact any land with a dry and temperate climate, having level wastes, may be found suitable for this industry.

Tasmania, however, is less adapted for the purpose than any of the neighbouring continental colonies, or than parts of New Zealand. Wooded, hilly or uneven country is quite unfitted for farming ostriches and grassy plains are found to furnish an insufficient variety in diet. Climate has also to be taken into consideration and even in the dry Wimmera district of Victoria rheumatism and cold have proved very destructive amongst the birds kept there.

Further, the statistics of Australasia offer little encouragement to introduce ostriches here. In South Australia, where they have been kept for many years, the total number of birds is, at the present time, only 725. In Victoria, where it is nearly 20 years since Sir Samuel Wilson carried out experiments at Longernong the increase is insignificant, and in New South Wales and New Zealand there are only small flocks.

But more cogent reasons still for deprecating their acclimatisation in Tasmania are to be found in the existing state of the industry in South Africa, where full-grown birds can now be purchased for from £3 to £4 each, or about the value of their feathers at the current rates. Strayed birds, barely worth the trouble and expense of recovery, become in certain districts a cause of much annoyance and even danger to persons travelling, so that it is considered unsafe to go out except when armed with a gun, and the state of affairs has been found sufficiently important to warrant the appointment of a select committee of the House of Assembly in the Cape Colony, who in their report dated 4th July, 1889, recommended the repeal of the Acts of 1870 and 1875, which imposed severe penalties for interference with wild birds or their eggs, and advocated perfect freedom for their destruction on private property and liberty to anyone to shoot them on Crown Land on payment of £5 for a license.

NOTES ON A RECENT DREDGING TRIP IN THE DERWENT.

By A. Morton, F.L.S.

The Tasmanian Fisheries Commissioners having decided to examine the several bays in the river Derwent, for the purpose of ascertaining whether, as in former times, there still existed natural oyster beds, advantage was taken of the opportunity to pay special attention to the marine fauna that might be obtained by the means of the dredge. Mr. A. Durrand, F.R.M.A., a gentlemen on a visit to Tasmania, who has made a collection of Foraminifera from many parts of the southern seas, accompanied us on our trip.

Several bays to the northward of the harbour were tried, but the dredge failed to secure any specimens of oysters, and in only one or two instances did we obtain any dead shells. Although from a commercial point of view the result of the dredging trip proved comparatively a failure, still from a scientific point we were amply rewarded. Instead of finding the Oyster, a large quantity of Pectens or Scallops were obtained. *Pecten meridonalis, P. bifrons, and P. asperrimus.* As has already been pointed out by Mr. Seager, the Secretary to the Fisheries Commission, a large number of this shell fish can be obtained in the river Derwent by means of the dredge, the quality being equal to the European Scallops, it is to be hoped that steps will be taken by our fishermen to place in the market this class of shell fish that should readily find consumers. As the places we dredged in were rather far up the river, the number of species of Mollusca were naturally limited, those obtained belonging to the genus Cardium, Fusus, Triton, Elenchus, and a few others well-known. A large number of a pretty shell known as *Modiolaria Cumingiana*, Dunker, were met with, inhabiting the sponge, and embedded in the larger kind of Ascidians. This shell is common in the Australian waters and also in New Caledonia. Several Crustaceans, chiefly of the smaller kind, were obtained, one kind being found in great numbers inhabiting the common Mussel. This peculiar little Crab, belonging to the genus *Pinnotheridæ Pinnotheres pisium*, Leach, I find has a very wide range common in the European seas, and although found inhabiting the Mussel of New Zealand, has not yet, I am informed by Mr. Thos. Whitelegge, the able Zoologist of the Australian Museum, Sydney, been observed in the Mussel found round the New South Wales coast.

Professor Hutton, Professor of Biology of the Christchurch University, New Zealand, on receiving two or three examples of this Crab writes as follows :—

"The male *Pinnotheres pisium* does not live in the bivalve, but wanders about; consequently he is rare, and only got by chance. I do not think the Crabs hurt the Mussels." I am, however, of opinion that occasionally the male Crab is found frequenting the bivalve, as among some 30 or 40 specimens

obtained by me in the Derwent, three or four were most certainly males. Since receiving Professor Hutton's letter I find, on referring to Mr. Thos. Bell's able work, entitled "A History of the British Stalk-Eyed Crustacea," the following remarks respecting this particular Crab:—"The species of this genus are very remarkable from the peculiarity of their being indebted to animals of a very different class for protection, although not truly parasitic. They are found always to inhabit the shells of the Bivalve Mollusca, pincipally of the Genera Mytilus, Modiolus, and Pinna, and occasionally also of the Ostrea, Cardium, and other Genera. The males are always very much smaller than the females." Bell's remark as to the scarcity of males agrees with what came under my notice during the recent dredging trip. He further states:—"This species, *P. pisium*, is very commonly found in the common Mussel, *Mytilus Edulis*, on many parts of our coast, and especially in those which are found in rather deep water. On one occasion I dredged great numbers of these Mollusca on the coast of Dorset, and found by far the greater number of them with one or two of these little soft bodied Crabs within their shells; for the females are much more common than the males. The latter sex I have occasionally taken apart from the Mussel shells, the former never."

A large number of species of a delicate Echini were met with, *Echinocardium Australe*, Gray, described by Gray in 1851. This species is found to have a very wide range, having been obtained in the N.E. and North Coast of Australia, Japan, S.E. Coasts of New Guinea, East Indies, Cape of Good Hope, New Zealand, and New Caledonia. The first specimens obtained in Tasmania were collected by Mr. Ronald Gunn in 1850, and referred to by Gray in the "Annals and Magazines of Natural History," 2nd series, vol. vii., 1851. Two species of *Holothuroidea* were obtained, one species, *Cucumaria*, having five rows of ambulacral feet, the other species, probably a *Psolus*, having only three rows of tube feet on a kind of foot, like that of some Mollusca. I forwarded some specimens of Cucumaria and Psolus to Mr. Whitelegge, of the Sydney Museum, who is unable to identify them with any species found in the Australian seas, and is of opinion that they may be new species. Several interesting specimens of Hydroid Zoophytes were obtained, chiefly of the following species:—*Sertularella divaricata*, Busk; var. sub-dichotoma, Bale.

P. L. S., N.S.W., vol. iii. n.s., page 761. S. *microgonia*, Lendenfeld. Bale, P. L. S., N.S.W., vol. iii. pt. 2., s.s. p. 763, pl. xvi., fig. 8. *Halicornopsis avicularis*, Kirch. Bale, Cal. Hydroida, p. 185, pl. x., fig. 1-2. *Aglaophenia divaricata*, Busk. Bale, l. c. p. 162., pl. xv., fig. 7-8., pl. xvii., fig. 6-7. Several species of Polyzoa were brought up, the follow-

ing species being determined:—*Catenicella Nastata*, Busk, McGillivray, McCoy's Prod. Nat. Hist. of Victoria, pl. 24, fig. 4. *Caberea Darwinii*, Busk, "Voyage of Challenger," vol. x., p. 29, pl. xxxii., fig. 6. *Amphiblestrum cervicorne*, Busk, McGill, McCoy's Prod. Nat. Hist. of Victoria, pl. 25. *Retepora carinata*, McGill, McCoy's Prod. Nat. Hist. Victoria, pl. 97, fig. 7. *R. avicularis*, McGill, l. c. pl. 95, figs. 7-11. *Cellepora rota*, McGill. Trans. Royal Society of Victoria, 1884. *C. albirostris*, Smitt, Busk, "Challenger's" Report, vol. x., p. 193, pl. 34, fig. 7, pl. 35, fig. 3. *Amathia tortuosa*, Tenison-Woods. Trans. Royal Society of Victoria, 1880. *Pustulopora Australis*, Busk, Brit. Mus. Cat. Polyzoa, pt. 111.

Several specimens of an alcyonarian coral were also obtained. *Acanthoisis flabellum*, Wright and Studer, "Challenger's" Report, vol. xxxi. p. 45, pl. xii. fig. 1. Sponges some five or six species were obtained. Examples I intend to have forwarded to Mr. A. Dendy, Demonstrator in Biology, of the University, Melbourne, for identification, who is at present paying considerable attention to the Spongidæ of Australia. Several specimens of Foraminifera were obtained. Mr. Durrand has kindly mounted an excellent slide for the Society, containing several genera.

From the large number of interesting specimens obtained during our recent dredging trip, and considering the very primitive and unsuitable dredge we had to use, I am convinced that a most interesting and valuable collection of marine fauna may be obtained in the Derwent, and have decided that during the summer months I intend to carry out a similar system of dredging to that I was engaged in for the Sydney Museum on the Queensland Coast and Port Jackson during the years 1879, 1881-82.

DISCUSSION.

In reply to His Excellency, Mr. MORTON described the localities where the dredging operations were carried on, and said that the biggest haul of scallops was found round the powder hulks near Government House. One gentleman from England described them as equal to the European quality.

Mr. CURZON ALLPORT said he would expect to find the largest bed of oysters near the entrance to the D'Entrecasteaux Channel. He knew oysters had been taken from there, and believed that many of the oysters found at Brown's River had come from that locality. Touching the scallops, they were at one time very numerous and were brought to market in considerable quantities. He now looked upon them as coming back again of late years like the oysters and mussels. Recently some good specimens had been obtained off Long Point, Sandy Bay.

Mr. MORTON said that since the dredging operations three oysters had been brought in from New Town.

Mr. CURZON ALLPORT said he had seen casual ones this side of Kangaroo Point.

NOTES OF SOME GEOLOGICAL OBSERVATIONS ON THE WEST COAST.

By A. Montgomery, M.A.

During a short visit to the mines of the West Coast in March of this year, I was able to make a few cursory observations of some geological features of the ground travelled over; and a few notes and remarks on these I have the honour to lay before you to-night. Travelling, as I was, rapidly, and for the set purpose of visiting the mines in the shortest possible time, I could not delay long enough to study the numerous interesting questions that presented themselves, and in this paper you will find that I rather state problems than contribute much towards their solution. By calling attention to points requiring elucidation, I hope that the numerous visitors to these till lately almost unknown districts who may have a taste for geological observation, may be induced to notice and record any facts that they may come upon that will throw light upon them. All facts thus noted and made known are stones cut ready for the hand of the builder, who will in time rear them into a noble temple of knowledge. In a newly-opened country we must first collect facts, however disconnected they may be; generalisations from them and complete knowledge will follow in due course. If these jottings, then, serve as foundations for more elaborate work, they will serve their end to the utmost of my hope.

On this occasion my route lay from Strahan to Mount Lyell, thence to the Howard Plains and back to Strahan, then on to Trial Harbour, Mount Zeehan, and Mount Dundas, then overland by Corinna and the Heazlewood silver field to Waratah. It was only such features as were apparent on the roadside that I could see at all. The keys to numerous questions to which I could give no answer may have been lying close at hand, but I could not delay to search for them.

The most interesting subject for geological research on the West Coast appears to me to be the relation to one another and to the sedimentary formations of the numerous igneous rocks, and the influence exerted by these upon the mineral contents of the mining districts. These igneous rocks comprise granite, greenstone, serpentinous greenstone, basalt, and a doubtful rock which may be diorite. Granite forms

the mass of Mount Heemskirk and the Meredith Range, and is also encountered on the Magnet Range, near Mount Bischoff. As quartz porphyry and eurite it comes in at Mount Bischoff itself. This porphyry is clearly intrusive through the slates there, as fragments of slate and sandstone are frequently seen embedded in it, and the workings of the Mount Bischoff mine also show it ramifying through the slate. One of the problems to be solved is the relation of this porphyry to the main granitic mountain masses; is it contemporaneous with their upheaval or intruded long subsequent to their formation?

The greenstones and serpentinous rocks are of much interest, more particularly as the serpentine at the Heazlewood is itself the matrix in which metallic lodes are found. There is probably more than a mere coincidence in the fact that serpentinous rocks are found in the vicinity of our three silver-lead fields, Mount Zeehan, Mount Dundas, and the Heazlewood. The intrusions of greenstone are met with in several somewhat widely-separated localities. On the road from Strahan to Mount Lyell, from the Queen River Hotel to about a mile past Lynchford, there is a large greenstone mass, which also is crossed by the prospectors' track from Lynchford to the Howard Plains nearly to the Queen River. As far as I could tell without analysis and microscopical examination, this rock is exactly the same as the greenstones which are so extensively developed in the central and eastern portions of the colony. I did not notice in it the change to serpentine that is shown by some of the other greenstones I have to speak of. Presumably, it has been intruded through the Silurian sandstones surrounding it, but its effect upon these as to local metamorphism, contortion, fracture, and mineral contents, has yet to be learned. It would be instructive to know if the veins and lodes of quartz traversing the Silurian strata are in any way affected by it, or show any evidence of having been caused by it.

Round Trial Harbour for about half-a-mile to the north and east there are steep hills of serpentinous greenstone, which decomposes to a dark red-brown barren soil, containing much magnetic and titaniferous iron ore. It is probably part of the same set of intrusive basic rocks as the serpentinous greenstone found nearer Mount Zeehan, extending for about $3\frac{1}{2}$ miles from above the Aguew Huts nearly to the Comstock mine. At the western side this rock has not been greatly altered, and is much like our common greenstones, but towards the east it gets more and more changed to serpentine. The razor-back ridge on Handley's section at Mount Dundas is somewhat similar serpentine, only finer for ornamental purposes, and contains asbestos and titanic iron ore. Serpentine is also found all along the boundary line of sections

$\frac{2303}{87}$ and $\frac{1851}{87}$, apparently forming the back of the hill into the face of which the Mount Dundas Company's tunnel is being driven. Though the serpentine rocks at the Heazlewood are considerably distant from the above, their similarity in lithological character would lead one to suppose that they also are related to the same series. They first appear on the road from Corinna to Waratah, at about thirty chains past the 21 mile post, at what are called the Eighteen-mile Huts. From there they extend on to past the Heazlewood and Heazlewood Extended mines. On the track from the Heazlewood to the Specimen Reef mine the serpentine extends to about half-a-mile from the crossing of the Savage River. The stone varies very much in appearance, from a greenstone to almost pure serpentine. Parts of it contain much schillerspar, and closely resemble gabbro. The appearance of all these serpentinous greenstones is consistent with the theory that the rock is a dolerite or gabbro, with its constituents metamorphosed by schillerisation, or internal chemical change, and by weathering, or external atmospheric influences. The more or less complete alteration into serpentine is probably due to the unequal distribution of olivine in the original rock. The change of olivine into serpentine would also account for the formation of the magnetic and titanic iron ore so common in portions of the rock. An interesting deduction from the appearance of these greenstones is that they were once very deeply buried, schillerisation being believed to take place only at great depths. It is possible, then, that these are the roots of one time mighty volcanic masses, possibly covering the western side of the island with their lavas. The microscopic study of these rocks promises a most fascinating field for the petrologist. Should there prove to be grounds for the idea I have advanced, that the volcanic rocks were once much more widely spread than now, the mineral nature of the country would be to some extent explained, the conditions being then such as may be presumed on many grounds to have been favourable for the formation and filling of mineral veins. Every fact that can be adduced to illustrate the history and relations of these intrusive masses will be of service to the cause of geological science in many ways. It has occurred to me that these old matamorphosed igneous masses may possibly represent the lower members of the great greenstone flows that have covered so much of the colony.

Throughout the mineral fields of Mount Zeehan, Mount Dundas, and the Heazlewood, there is another set of igneous rocks that appear to be of quite different character from the greenstones. They seem to be closely connected with the mineral veins, and when more is known about them, I am inclined to believe that the connection will be found to be even closer than it at present appears. They are so much

decomposed wherever I have met with them that it is quite impossible to name the rock with any accuracy. As far as can be judged from the decomposition products, it must have been chiefly composed of felspar and hornblende without free quartz, and is likely therefore to be a diorite or hornblende andesite. Till further research reveals its true nature we may without much inaccuracy speak of it as a dioritic rock. I noticed it more especially at the Mount Zeehan and Whyte River Silver-fields, but at Mount Dundas there are also rocks of this series. At Mount Zeehan it is found plentifully on the main road between the Comstock and Silver Queen holdings, some of the belts being close on a quarter of a mile in width. It is notable that the slates in this vicinity are much contorted and broken by small faults, as may be seen in the roadside cuttings. The dioritic rock is most easily distinguished by its coarse granular appearance on the fresh fracture, and by its clayey nature, being almost free from grit. On the surface it forms a stiff yellowish brown clay, quite unlike the dark red-brown clay resulting from the weathering of the serpentines. In the Argent, Balstrup's, Silver Spray, and Western mines it is cut through by tunnels, also in Evans's section $\frac{11}{87}\frac{10}{}$, and a dyke of it was noticed in section $\frac{14}{87}\frac{70}{}$ of the Tasmanian Silver Mining Company. In Balstrup's and the Western mines it clearly occurs as dykes penetrating the Silurian country slates and sandstones. In the Argent tunnel no lodes were met with in it, but some veins of pyrites and loosely coherent quartz crystals were passed through. The inner end of the adit is in clay slate, the outer half being in the volcanic rock. This has here much the appearance of a tufa, and may prove not to be a weathered dyke penetrating the slates, but a tufaceous bed resting upon them. In the lower tunnel of the Silver Spray company the igneous rock is clearly of a fragmentary character, containing numerous angular fragments of clay slate imbedded in the clayey matrix of weathered volcanic rock. Here we probably have a remnant of a tufa bed, most likely one of many that were formerly widely spread over the district. Some quartz veins were found in this tufaceous rock, and on the surface there is a large mass of gossan, supposed to have been the cap of a lode, until the tunnel was driven underneath it and far past the line of it on the surface without success. Quartz veins and a lode of quartz of considerable size are also found traversing the dioritic dyke in Balstrup's section, and in the similar dyke near the Whyte River on which Godkin's, Smith and Bell's, and the Whyte River company's claims are situated, quartz veins have again been found. The outcrops of both these dykes, too, are marked by large masses of gossan. It appears to me that the weathering of the dioritic rock is of itself

quite capable of producing deposits of iron ore on the surface, without there being any lodes required to account for their formation. The ferruginous waters resulting from the solution by carbonic acid of the iron of the rock on coming to the surface are sure to deposit their iron as hydrated oxide. A gossan formed in this way would be rather a bog iron ore than a true lode gossan; and many of the so-called gossan outcrops on these silver-fields appear to me rather to be beds of surface bog iron ore than true gossans. The highly ferriferous serpentine rock has yielded much surface bog iron ore in the same way, as may be seen on the road from Trial Harbour to Mount Zeehan, almost immediately after coming upon the serpentine. Too much importance should therefore not be attached to gossan outcrops as indications of mineral lodes. In this connection, too, I may point out that it frequently happens that quite a small lode has a large "iron hat" owing to the ferruginous waters issuing from it spreading over the surface of the ground. A big "gossan blow" need not cover an equally big lode by any means. In making these remarks I am not forgetting that in Smith and Bell's section the gossan is in at least one place clearly derived from the oxidation of a lode containing much carbonate of iron.

At Mount Dundas I did not notice any dioritic dykes, but in the southern of Webster and Bennett's sections I found a volcanic breccia of fragments of felspathic rock, similar to the diorite. In all probability the igneous rocks will prove to be common at Mount Dundas as well as at Mount Zeehan. Their intrusion may have been the cause of the fractures in which the lodes formed, and the solfataric action accompanying volcanic activity may have had much to do with the filling of the fissures with their mineral contents.

Between the Whyte River and the Magnet Range there is a large quantity of a rather fine-grained greenstone, which does not closely resemble the serpentinous greenstone on the west side of the Heazlewood field. In the cuttings for the road on the long grade down from the top of the Magnet Range, this rock is seen penetrating the slates and altering them to hard brown porcelain-jaspers. I am not at all clear as to whether this is not yet another separate igneous intrusion. Analysis and microscopic comparison with the other greenstones are required to solve this problem, together with field observations to the northward of the Whyte River silver-field, where the Magnet Range greenstone seems likely to join with the serpentine rocks.

The basalt dykes and flows met with on the West Coast all probably belong to the series of tertiary basalts found abundantly along the North and North-West Coasts. About 10 miles and 8 miles south of Corinna I noticed two dykes or

streams of basalt crossing the road, the first about a quarter of a mile wide, the second about half that width. It occurs again at 21 miles from Corinna on the road to the Heazlewood, and on the track to the Specimen Reef at about one and a half and quarter miles from Hall's Creek. Round Waratah it is rather extensively developed. Looking southward from the top of Mount Bischoff it appears likely that the plateau, out of which Mount Pearse stands up like an island from the sea, is all basalt. If this is the case there is a very interesting geological problem here, to determine as far as possible the configuration of the country previous to the lava flow. This may have important economical results in leading to the discovery of buried tin-bearing leads heading from Mount Bischoff. Ever since the discovery of this wonderful ore deposit, the small quantity of alluvial tin ore found in the creeks running from it has been a subject of surprise to observers, and the existence of leads buried under the basalt has frequently been conjectured. The interesting leaf beds underlying the basalts at Waratah have more than once been brought under the notice of this Society. As usual, the basaltic soil appears to be very fertile, and in the event of a large population becoming established on the West Coast, these strips of good land will doubtless be very valuable for farming purposes.

The questions connected with the igneous rocks are by no means the only interesting geological problems that present themselves. Others there are in profusion, apparent even to the cursory glance of the passing traveller. I may mention some of these, not to throw any light upon them, but merely to direct attention to them. The Tertiary leaf beds fringing Macquarie Harbour have been scarcely at all studied as yet, though Dr. Milligan and Mr. R. M. Johnston have made a valuable beginning and given us a glimpse of the riches there awaiting both botanist and geologist. The sand dunes through which the railway passes between Strahan and the Henty River also deserve some attention. They extend inland from the beach for a very considerable distance, and are now covered with a dense growth of ti-tree scrub. Are they overlying the leaf beds, or do they lie against the face of an escarpment of these such as we see at Strahan? The latter seems to me at present the more likely. But apart from their geological age these dunes suggest some interesting questions: How have they been formed? Have they been caused by the sand being blown inland from the beach, as we know sand dunes frequently are formed, encroaching on low-lying coast lands and gradually covering them, or has their growth been quite in the opposite direction by the sand accumulating on the beach gradually extending further and further seaward, and so reclaiming a strip of shore? If, as

seems likely, Macquarie Harbour once had a wide mouth instead of a narrow one, and the sand driven southward by the north-westerly winds has gradually formed a sandspit from Strahan to the Heads, it seems likely that the dunes represent successive lines of sandhills formed above high water mark, and that the land has been reclaimed by the constant deposit of sand brought in to the shore by the action of the winds and waves. The reclamation would be similar to that which often takes place in the angle where a breakwater meets the shore line on the side exposed to the prevailing winds and currents. In this case Cape Sorell and the strong current from the Harbour would be the obstacles preventing the further southward travel of the sand, and causing it to accumulate on the beach to the northward. If this suggestion is correct, the depth of the deposit of sand is probably considerable, much more so than if the dunes were formed by the action of wind alone. Perhaps some of the railway cuttings may throw some light on the question. It is interesting from an engineering as well as from a geological point of view, and has a certain bearing upon the proposed harbour works at Macquarie Heads. From its geological aspect, a section through such a sand deposit as I have indicated would exhibit an instructive succession and overlap of horizontally bedded sands, false bedded sands, and blown sands.

The gravel deposits in the neighbourhood of the Pieman River and along the road from Corinna to Long Plains deserve some attention. They cover a large extent of country, and are found at very various levels, and they appear to have been laid down when the river systems were not altogether as they now are. As gold has been found almost universally in these gravels, though in small quantity, they may become of economical importance, and leads may be found in them. Their distribution and formation are therefore worthy of study.

An alluvial deposit at the Linda River, in the neighbourhood of Mount Lyell, where sluicing operations for gold are being carried on, also came under my notice. The streams that piled up the auriferous gravels were probably much larger than those now existing. Under the gravel there is a peaty bottom, containing very numerous fragments of wood, apparently of one of the pine family. Below this bottom another layer of gravel has been found in places. Search would probably reveal leaf beds, from which valuable information might be obtained. The alluvial flat through which the Linda Company's tail-race runs, may very probably have been at first a small lake, then gradually filled up to a marsh, and finally covered over with a layer of gravel. If so, what force scooped out the Lake basin? Was it a glacier,

or has a landslip blocked the exit from a valley, and so formed a lake?

There are any number of other points on which information would be useful, sometimes purely in the cause of science, but oftener, perhaps, on account of their bearing on the mining industry; but in rapidly traversing the district as I did, it was of course impossible that I could take any note of nine-tenths of them. For example, I had no time to look for fossils, though some of the localities passed through are evidently rich in them, and if one had the opportunity of examining them, doubtless many discoveries would result. A cutting in the main road close to the Government township of Mount Zeehan is especially rich, and will doubtless be much visited by collectors on account of its easy accessibility. The sandstones between the Heazlewood and Whyte Rivers are also fossiliferous.

In conclusion, I have to say that these notes are given for what they may be worth as to the facts related in them, for I confess I attach no importance to any theories I have indulged in, and am quite prepared to find that further exploration will disprove them, or cause them to be altered beyond recognition. If I have succeeded in drawing your attention to the extent and variety of the geological harvest that stands waiting to be gathered, I shall have done all that I can hope for at present.

At some future time, after the more elaborate examination of these districts, which, as time goes on, I hope to have opportunities of making, I trust that I may have the honour of bringing under your notice solutions of some of the problems that to-night I have only been able to mention as existing.

OBSERVATIONS ON THE INFLUENCE OF STRIKES UPON REAL WAGES.

By R. M. Johnston, F.L.S.

At the present moment in Europe, America, and Australasia, many industries are paralysed and the well-being or comfort of thousands of families are more or less sacrificed by organised or enforced idleness involving a considerable diminution in the creation of commodities or real wealth. These Strikes, as they are termed, are entered upon by thousands of honest, hardworking, peace-loving men. In loyalty to their order and to their recognised leaders, they display many characteristics which cannot but excite some degree of wonder and admiration; for this voluntary suspension of the means of livelihood to them not only involves unflinching self-denial of ordinary comforts, but also the facing of a terrible risk that in the dark, prolonged struggle, the lives of those that make life dear to them may be crushed and overwhelmed by want and misery.

Facing such risks, it is only natural that the ordinarily peaceable man should become restless and excited, nay, violent, when the campaign of self-sacrifice and loyalty to their fellows seems about to be jeopardised by the opposing action of those who seem to them to be lawless renegades of their order.

Those of the community whose interests are in conflict or are not supposed to be immediately affected by a combined strike—whether for shorter hours, resistance to the lowering of the rate of wages, or the raising of wages—may be surprised and may condemn "unionists" on Strike for violently opposing the filling up of their places by so-called outsiders, freemen, non-unionists or blacklegs, but a little consideration from the standpoint of "Put yourself in his place" will reveal much that tends to palliate their modes of action or behaviour, if it does not exonerate or justify them. Be it remembered that their hope of success entirely depends upon their loyalty to each other under the most severe strain to human beings, viz., privation and misery; that their battle squares, if broken entails defeat; that the breaking away of any of their number or the intrusion of opposing outsiders destroys all their hopes, make their prolonged sacrifice of no avail, and leaves them in a much worse position than at first.

On the other hand (making allowance for mistakes in judgment), there is much that is admirable in the sympathetic, sacrificing support of brother workmen in other trades or

divisions of labour, who, although not themselves immediately concerned, yet voluntarily resolve to help by docking 1s. per week from their own small earnings, nay, often sacrifice for a time their earnings altogether where it is thought that a Strike in their own branch would serve more speedily to bring their brother-workers' campaign to a successful conclusion.

In the present day—with its hard and fast divisions of labour, its fluctuations of demand and supply, its hordes of unemployed, and its crushing competitive rings and interests—the intelligent wage-earner perceives plainly enough that as a unit he is perfectly helpless, and that he can only succeed in bearing up against opposing organised interests by a similarly organised action.

No one who has closely followed the struggles of workmen during the last thirty years can fail to perceive that upon this organisation (solidarity) rests the whole strength of their position in the industrial scheme, and that anything which tends to weaken or demoralise their centres of organisation, meets with their most strenuous resistance; for it is manifest to them that the breaking or weakening of the heart or centre of their organisation detaches them again to helpless units who are unable to enforce any claim whatever.

It will be conceded, therefore, when it is proposed to ask the question, *Can Strikes raise Real Wages of Wage-earners all round?* that the writer is one who regards combination or co-operation amongst wage-earners as of paramount necessity to them, and that when all better modes of appeal for reasonable concessions are unavailing, the last and terrible resort "to Strike" may in certain cases not only be justifiable but imperative.

Strikes can only Succeed in Raising *Real Wages* when it is Partial or Confined to Industries that Comprise a Small Proportion of the Community.

While much has been granted in favour of organisation, and the right to resort to Strikes under certain circumstances, it cannot be concealed that many expect by organised Strikes to effect what is plainly an utter impossibility, even if employers gave way at every point.

A Strike may be the means of successfully raising the status of some branches of labour that are comparatively underpaid or over-worked; it may raise the *real wages* of a particular country or locality which formerly laboured under the average remuneration of other countries; it may temporarily be the means of forcing the capitalist or employer to give a fairer or larger share of the profits of capital and labour—*i.e.*, machinery plant, skill, and labour—but from the very nature of the common source of all profit and

wages [viz.—the *current products* created by the combined services of capital (instruments) and labour], Strikes cannot raise the *real wages* of *all* wage-earners.

In other words, it is possible to regulate and alter the distribution of the aggregate wealth of consumable necessaries of life, but so long as this aggregate wealth fails to be increased per capita per year, Strikes cannot increase the *real wages* or the purchasing power of a day's labour of *all* wage-earners. In a word they cannot divide more than what has actually been created or produced, although the *nominal rates of wages* and *nominal prices of commodities* may both be raised to any extent without real benefit to anyone.

To secure a general nominal rise of wages in *all* branches of labour would further have the immediate effect of lowering once more the *real wages* of those who already had effected for themselves an advantage by successful combination or Strikes. This may seem hard to believe by many who have not taken the trouble to discern the fundamental distinction which exists between *real wages*—which alone can improve the workman's condition—and *nominal wages*, which, if raised ever so high, in all branches of labour, leaves the workman just in the same condition as at the beginning.

But, directing the attention to the fact that there is an important distinction, it may prepare the more thoughtful to contemplate that there is something underlying these terms which they would do well to understand, for it cannot be too often asserted that Strikes might possibly raise the *nominal wages* of workers all round a hundred-fold, and yet result in the positive lowering of the *real wages* of all workmen who, by means of organisation, hitherto have succeeded in bettering their condition as compared with their less perfectly organised fellow-wage-earners. It is the failure to recognise the essential difference between *real* and *nominal wages* that renders futile the many schemes of sentimentalists, which have for their object the laudable design to improve the condition of the people.

Real and Nominal Wages.

No one has more clearly defined the nature of *real* and *nominal wages* than Mr. George Gunton, in his admirable work "Wealth and Progress." He states (p. 74): "By *real wages* is meant the actual amount of wealth (social well-being) obtainable by a day's labour. By *nominal wages* is meant the amount of *money* obtainable by a day's labour." In other words *real wages* means the actual purchasing power of a day's labour, while *nominal wages* may or may not always afford a correct index of the comparative purchasing powers of a day's labour. For example, in England the minimum supply of the necessaries of life for a workman and his

family for one day may be secured by a nominal expenditure of 4s. in money. If his nominal or money wages for a day of nine hours be 5s. then the purchasing power of his real wages for one day's labour is equivalent to the command over 1 1-5th days of the necessaries of life. If the same necessaries exactly in America cost a nominal or money value of 6s., it follows that a nominal or money wage of 7s. 2·4d. for a nine hours day in America would only have the same purchasing or real wages value as the nominal or money wage of 5s. per day in England.

Now, as it can be shown that the nominal cost of a day's labour mainly determines the ultimate nominal cost of the commodity, product, or service related to that effort, it follows that if *nominal wages* all round were arbitrarily raised 20 per cent. without actually increasing products, it would inevitably result in raising the *nominal* prices of commodities or necessaries all round to the same extent, and thus leave the purchasing power or *real wages* of the labourer in the same position as at first.

It has been purposely assumed that this effect would only be brought about where the arbitrary increase to *nominal wages* was equally spread over all classes of wage-earners; for it is not denied that an arbitrary increase to *nominal wages* if restricted to a few industries might increase both the *nominal* and real wages of these trades; but in all such cases it would be obtained by a proportionate *decrease* of the purchasing power or *real wages* of every other class in the community who were obliged to purchase the products so enhanced in price of the various industries who succeeded in having the *nominal* wages so raised. It is the consumers of products or services who would ultimately lose by the advantage gained by the industries whose wages were nominally raised, and not the capitalists and employers who directly were obliged to advance the *nominal wages*.

It is only under such restricted circumstances where Strikes could really benefit any industry by raising *real wages*. They would of necessity fail to raise *real wages* if the *nominal wages* of every class were raised by the same percentage of increase as has already been explained. Unfortunately the workers in many industries whose labour is worst paid (*e.g.*, seamstresses and agricultural labourers) lack organisation, and thus fail to improve their position among other labourers, although the nominal cost of the necessary satisfactions of life is the same to them as to the better paid wage-earners. But here again it must be borne in mind that any increase in *real wages* gained by them by the nominal raising of wages could only be secured where the *nominal* increase to wages is restricted to a few industries. This is made all the more apparent when we try to estimate (however roughly) the

composition, numbers, and nominal earnings of the various classes of any Society.

It is impossible with our present knowledge to gauge all such conditions accurately, but if, for example, we divided all Breadwinners—Rich and Poor—into, say, five distinct groups, thus—

		ASSUMED PROPORTION.
1. Upper Class Rich, say ...	1	per cent. of Breadwinners.
2. Middle Class „ ...	5	„ „
3. Higher Industrial and Artisan „ ...	15	„ „
4. Middle Industrial „ ...	20	„ „
5. Lower Industrial „ ...	59	„ „
	100	

If, further, the total satisfactions secured per day amounted to £33 6s. per 100 Breadwinners, and were divided as follows:—viz.: for the 1st, 40s.; 2nd, 20s.; 3rd, 10s.; 4th, 7s.; 5th, 4s., we may ask—What, then, would be the effect upon all if the satisfactions were equally distributed according to the day's labour, disregarding the nature, quality, or quantity of the work or service performed by the various classes? Some indication of the effect that would be produced is shadowed forth in the following table:—

	Per-centage pro-portion.	SATISFACTIONS PER DAY Assumed existing proportion.	Total. s.	Total Satisfactions if equally distributed. s.	Increase or decrease per cent.
1. Upper Class Rich	1	@ 40s.	40	6·66	— 83·3
2. Middle Class	5	@ 20s.	100	33·30	— 66·7
3. Higher Industrial & Artizan	15	@ 10s.	150	99·90	— 33·3
4. Middle Industrial	20	@ 7s.	140	133·20	— 4·8
5. Lower Industrial	59	@ 4s.	236	392 94	+ 66·5
TOTAL OR MEAN ...	100	6·66s.	666	666	——

From the preceding table it would appear that if all classes shared equally in the satisfactions assumed to be created by the aggregate labour of men, only the lowest would receive a positive increase, while the four higher would lose a considerable per centage, amounting to a decrease from 4·8 per cent. in the Middle Industrial to 83·3 per cent. in the Upper Class Rich share. Even the Higher Industrial and Artizan Class, who often dream that a redistribution of wealth would be to them of untold advantage, would, as shown, probably lose 33·3 percentage of their present allotted share of created satisfactions if the world's created wealth were equally distributed among all men.

This equality of distribution is the dream of many

NOTE. — Indicates Decrease. + Increase.

Socialists, whose present share of the satisfactions of life would certainly have to be lowered, not raised, if their visionary schemes could be carried into effect.

In conclusion it seems only too true, as asserted by Mr. Gunton, "That nothing can improve the social condition of the masses, whether it raises nominal wages or not, which does not increase the general rate of *real wages*, the degree of which may be universally taken as the accurate measure of social progress;" and, "there are no economic means by which the material condition of the masses can be permanently improved which do not tend to increase the aggregate production of wealth per capita." Invention, increasing command over the forces of nature, thrift, and industry can alone accomplish this. Schemes of Distribution and Strikes for higher nominal wages must end in failure and disappointment, so far as the great masses of men are concerned.

It would be well for capitalist and wage-earner, employer and employed—whose interests as producers and *consumers* are almost identical—that when matters requiring adjustment are proposed, there should be greater facilities afforded in the Councils of both interests for securing a friendly settlement. So long as high-handed action on either part bars the way to the friendly conference of *acknowledged representatives* (except after the bitterness and friction of an industrial war), so long will the unsatisfied claims, the suspicions and misunderstandings of both parties, result in injury to both; and to the absence of these facilities, mainly, may be attributed the most disastrous of all such evils, viz. Strikes.

CAN STRIKES REALLY IMPROVE THE CONDITION OF THE MASSES?

By A. J. Ogilvy.

The question—the very serious and practical question raised in Mr. Johnston's late interesting paper is this—Can the toiling masses really improve their condition by these incessant and unhappy Strikes, or are they only beating their hands against the iron bars of inexorable Economic Law?

That, at any rate, whether it exactly represents what Mr. Johnston meant or not, is the great question of the day; and it seems a very plain question. Yet, plain as it seems, one or two other questions appear to have got rather mixed up with it which are no part of it all. For instance, the question is not whether if all nominal *incomes* were raised real incomes would be raised too, and that if everybody had twice as many shillings, other things being unaltered, everybody would be twice as well off.

The most ignorant striker does not imagine this for a moment. He understands perfectly well that the increased pay that he expects to get must come out of somebody else's pocket. Neither is the question whether "men can divide amongst themselves more than is created or produced." Of course not. We might as well be asked to debate whether 2 and 2 could make 5. That is not the great Strike question.

Briefly summarised, the proposition placed before us in Mr. Johnston's paper is that strikes, if carried out on any extended scale, must fail, because a mere increase of nominal wages, unaccompanied by any increase in production, cannot really improve the condition of the masses. The aim of this paper is to show that it can. The proposition indeed ought to be reversed and stand thus:—No increase of production can improve the condition of the masses unless accompanied by an increase of nominal wages. The nominal wages are the main thing, because it is not an increase of production, but an alteration of distribution that is aimed at.

What we are concerned with is an increase of *wages*, that is, of the income of the *masses:* of the lower 10 millions whose toil is the active factor that produces all wealth, not of the upper 10 thousand who in some mysterious way manage to get rich upon that toil.

Society, in the view of the masses, may be roughly divided into 3 classes:

(a.) Those who derive income absolutely without any effort of their own, and consequently from the efforts of other

people. Of these are receivers of ground rent, holders of state bonds, money lenders, shareholders in companies, and so on.

(b.) Those who do contribute some effort, but effort absurdly disproportionate to the income they receive. For example, the manufacturer who makes some thousands a year by only some 4 or 5 hours attention to business a day, while his factory hands only get £1 a week or so for some ten hours work a day.

(c.) Lastly come the toiling masses who bear practically the whole burden and heat of production, and yet gain but a mere subsistence. This last class thinks that the two first classes get much more than their fair share, and it strikes in order to make them disgorge. A strike, then, is a movement of the underpaid against the overpaid.

Whether the two first classes do really get more than their due is a matter that we have nothing to do with at present. We are not concerned with the ethics of the question. All we have to enquire is, not whether strikes *ought* to succeed, but whether they *can*.

In the primary industries, that is in those which are concerned in extracting or producing the raw materials of wealth from the land (as in agriculture and mining), where certain lands only are suitable for the purpose (as for instance fertile lands for agriculture, and mineral lands for mining), and the intending users are much more numerous than the owners, there is keen competition for possession of such lands, and the competitors run each other up in rent. In all such industries every increase of wages will come out of the rent. For rent (or, at any rate, that portion of it which we are now concerned with) is simply the surplus which remains after paying working expenses and tenants' "ordinary profit;" and every rise in the expenses or fall in the profits will reduce the rent proportionately. Take agriculture. In every lease the rate of wages and the price of produce is tacitly accepted on both sides as the basis of the whole calculation; and both landlord and tenant understood quite clearly that if wages rise or prices fall, not as a mere fluctuation, but with every appearance of "settled weather," the rent will have to be re-adjusted at the first opportunity. But royalties on minerals are but rent under another name, and are determined by exactly the same calculations. Think what a vast area of industry, and how great a body of workers are represented in this category! It includes the raising of every description of crop, and all grazing, dairying, and many other products; also all coal, iron and metal of all sorts, building stone, slate, lime, china, and brick clay, and minerals too numerous to mention, in all which every increase in the cost of the working will come out of the rent. It covers also not only all those who

are actually on the land, but all who are directly or indirectly engaged in providing the appliances or placing the product in the market. A strike of the seamen who carry the coal, or of the artificers who make the mining appliances, will fall on the landlord as surely as will a strike of the actual miners, and for the same reason, viz.: that it increases the cost of placing coal in the market, and so leaves a less surplus available for rent. In every department of industry, then, which is concerned in supplying the raw material of wealth from the land, every enforced rise of wages will be clear gain to the labourer, because the loss will fall upon the landlord, *and stay there.*

But in the secondary industries; in those industries which are concerned, not in extracting the raw materials of wealth from the land, but in working up and distributing those materials (as in manufactures and commerce), in which the land is not an active factor, so to speak, in the work, but is required only as a site, one site doing (within certain limits) as well as another, where consequently trade competition is not for possession of the land but for custom, and the competitors run each other down in price instead of running each other up in rent. In all these industries increased wages will signify increased price of goods.

But these goods again are of two kinds, those which the masses consume, and those which they do not. On those which they do not consume no increase of price will affect them.

Few people realise how vast a proportion of the industry of a rich country like England is concerned in providing luxuries and enjoyments for the rich. Taking goods only, and putting mere services aside, one has only to walk down the street glancing in at the goods displayed in the shop-windows to see that the greater part consists of goods quite out of reach of the masses, and in which consequently no increase of price will concern them. The butchers and bakers, the grocers and the clothiers, are the chief shops which the masses deal with, and even in these, in the two latter at any rate, the greater quantity, whether measured in variety or in value, consists of articles of luxury available only to the well-to-do; while in many shops the display exhibited contains hardly a single article within reach of the poor.

In all those commodities, then, which the underpaid do not consume, the loss due to increased wages will fall upon the overpaid, *and stay there*, again leaving the whole net gain to the labourer.

Lastly we come to those goods which the masses do consume, and which will rise in price. Here the strikers will suffer a loss, but the loss will not equal the gain even on these goods. In the case of primary products, such as food, the greater part of the loss due to increased wages will, as we have seen, be deducted from the rent instead of added to the price.

In the case of secondary products, manufactured goods, as say for example *boots*, the cost will be added to the boots; but it will not be all piled upon the labourer's boots, the boots of the overpaid will bear their share. If in consequence of a boot-makers' strike an increase of *£1,000* in wages had to be paid for a given turn out of boots, then *£1,000* would have to be added to and distributed amongst that turn out of boots; the overpaid would have to bear all the added cost that accrued to their boots, leaving the underpaid to bear that part only which accrued on *their* boots; and the share that the overpaid will have to bear on their boots is not to be measured merely by their numbers, for the boots used by a rich man are generally much dearer, representing a good deal more labour than the boots used by a poor man.

To sum up so far, let us express the argument in figures; not pretending for a moment that the figures are even approximately correct, but simply to illustrate our meaning.

Suppose then that in consequence of a series of concerted strikes among the whole class of labourers wages generally were increased by £30,000 a month, we might say that—

10,000 would be taken off rent instead of added to price.

10,000 more would be added to price, but to price only of goods which the strikers did not consume.

And of the remaining *10,000*, $\frac{1}{5}$ (or *200*) would be paid by the richer classes who consumed their share of such goods, leaving only *8,000* to be borne by the strikers on *their* share.

The profit and loss account to the strikers would then stand thus—

Taken out of rent and added to wages ...	10,000
Levied on rich purchasers of luxuries and added to wages	10,000
Levied on necessaries and small comforts and added to wages	10,000
Total	30,000
Deduct increased price on strikers' own purchases	8,000
Net gain to the strikers	22,000

It is said, however, that if the upper classes lose so much there must be so much the less employment for labour, and so the loss will come round to the labourer after all.

There will be no less employment.

For why will the upper classes have got so much less? Simply because the lower class has got so much more. It is not a loss but a mere transference of employing power. What the masses want more money for is to spend it, and they can

only spend it in purchasing goods and hiring services just as the upper class did. They will in short, to the extent of the transference, be employed by each other instead of by their old employers.

My time being limited, I have been obliged to state my case in broad outline, without going into details and qualifications, but there are one or two such qualifications, real or apparent, that we may have time to glance at.

1. There is of course a limit to the rise of wages. The labourer cannot earn more than his labour produces. But this limit is a long way off; what the labourer actually gets is a very small portion of what his labour really produces; and the question before us is not whether there is such a limit, or how far off it is, but whether strikes, as strikes, can under present circumstances really improve the labourer's condition or not.
2. It will be said that the fall of rent which we have predicted will throw some lands out of use, and so actually diminish the total production of wealth. That is to say, that land that now yields current wages to labourers, and profit to employers, but only a small surplus for rent, will then yield no rent at all; in which case the landlord will withdraw such land from use and devote it to his own amusement, say for sport.

Well, that opens up a question about which you will hear more before long, viz.: the question whether a man who claims to be sovereign lord and master of a certain portion of the earth's surface shall be allowed deliberately to prohibit all productive industry on that area, to forbid willing labourers from working, and enterprising capitalists from investing merely because such enterprise will not yield blackmail to him, as well as profit and wages to the workers.

But passing that by, I would point out:

1. That a more equitable distribution of the produce of labour is a boon so great in itself as to be well worth some cost, and that we need not be dissatisfied because less luxuries are produced for the few very rich, if more comforts are provided for the many poor; not even though the loss in value on the luxuries exceeds the gain in value on the comforts.
2. That it is only the very worst lands that will be withdrawn, and the loss through the withdrawal of these worst lands will be more than compensated by the more effective utilisation of the better lands; for these better lands will now be tilled by better paid men, and well paid labour is more effective than badly paid labour.

Allow me here to quote a short extract on the advantage of high wages.

"But high wages are not only a sign of progress, they are also a factor of progress, and this in three ways:—

1. When the labourer is well paid he becomes more intelligent and skilful, more self-respecting, a better man all round. I do not mean that wherever the labourer is poorly paid he is dull, unskilful, immoral, and that wherever he is highly paid he is all that he ought to be; for many agencies go to the making of character besides the rate of wages. But I mean this: that, given any labourer of the character that he is, however produced, higher wages will make him better, not worse—more efficient, not less.

2. High wages induce clever men to invent, and compel slow men to adopt labour-saving contrivances of all sorts, and so add to the productiveness of labour. Employers do not bother themselves about inventions where labour is dirt cheap. In the making of the Suez Canal, the sand was excavated with common hoes, and carried out on women's heads, though steam excavators and elevators were well known, and would have saved nine-tenths of the labour. But the labour wasn't worth saving—to the contractors. Improved appliances in agriculture are in much more general use in America and Australia, where wages are high, and because they are high, than in England; and more in use in England than on the Continent, for similar reasons.

3. High wages, like free-trade,* help to weed out weak industries, and to concentrate labour where it is most effective, as already pointed out." *

It may be said again that the increased price referred to of goods consumed only by the upper classes will diminish the consumption, and that to that extent the labourer will fail to shift the burden of his increased wages on to the rich consumer. Granted. But the effect of this would merely be to diminish the successfulness of strikes, and the question before us is simply whether strikes *when they are successful* can really improve the labourer's position. I have tried to show that they can. It is for the present company to decide for themselves whether I have succeeded.

* Extract of a paper, "Land Nationalisation," by the author (reprinted by permission), from the Co-operative Wholesale Societies' Annual, 1890, and issued by the Land Nationalisation Society: Manchester, 1890.

GENERAL INCREASE OF WAGES FALLS UPON CONSUMERS OF PRODUCTS, AND IN NO WAY ENCROACHES UPON RENT OR PROFITS OF CAPITALISTS.

By R. M. Johnston, F.L.S.

Different observers standing at different points of view in the midst of many complex problems are hardly ever likely to concur in each others conclusions if their respective views are limited to a few isolated facts, belonging to but still forming an insignificant part of the whole series of facts upon which the true solution of the complex problem depends. Each observer under such conditions may arrive at opposite conclusions, which may be perfectly consistent with the fragmentary data upon which they respectively rest, and yet be altogether wrong and inconsistent when correlated with the more important series of *co-efficients* which were overlooked or ignored.

The conclusions of even the most extended observations may also be consistent with the data upon which they are based, and yet be altogether inconsistent with the truth, if the data themselves be inaccurate. Further, there are always some points so difficult of solution that only the powerful restraint of a particular habit of mind or training can prevent ones sympathetic leanings from leaping the gap to the goal desired in preference to the wiser course of making further exploration or waiting for further gleams of light.

These observations are necessary when called upon to review the arguments of Mr. Ogilvy, in so far as they are supposed to touch upon my former paper on Strikes and their Influence upon Wages. It affords me great pleasure to find myself in agreement on so many points with one like Mr. Ogilvy, whose well-known generous sympathies for the amelioration of the condition of the masses of the people must command the respect of all right thinking persons. We are substantially in agreement in the view stated by me in my former paper, that "A strike may be the means of successfully raising the status of some branches of labour that are comparatively under-paid or over-worked; it may raise the *real wages* of a particular country or locality which formerly laboured under the average remuneration of other countries; it may be the means of forcing the capitalist or employer to give a fairer or larger share of the profits of capital and labour—*i.e.*, machinery, plant, skill, and labour—but from the very nature of the common source of all profit and wages, viz., the current products created by the combined services

of capital (instruments) and labour, strikes cannot raise the real wage of *all* wage-earners."

In other words, it is possible to regulate and alter the distribution of the aggregate wealth of consumable necessaries by means of strikes.

So far there is a substantial agreement between us.

It is in the following statement made by me wherein our views are in diametrical opposition, viz.:—(1.) "It is not denied that an arbitrary increase to *nominal wages*, if restricted to a few industries, might increase both *nominal* and *real* wages of these trades; but in all such cases it would be obtained by a *proportionate decrease of the purchasing powers or real wages of every other class in the community who were obliged to purchase the products enhanced in price of the various industries who succeeded in having the nominal wages so raised*," and more especially is the fundamental difference between us set forth in the next paragraph used by me, viz.:—(2.) "It is the *consumers of products or services who would ultimately lose* by the advantage gained by the industries whose wages were nominally raised, *and not the capitalists and employers as such who directly were obliged to advance the nominal wages.*" And again, we are diametrically opposed in relation to the following observations of Mr. Gunton's, with which I am completely in accord. (3) "That nothing can improve the social condition *of the masses*, whether it raises the nominal wages or not, *which does not increase the general rate of real wages* (*i.e.*, purchasing power) *the degree of which may be universally taken as the accurate measure of social progress*," and "there are no economic means by which the material condition of the masses can be improved which do not tend to increase the aggregate production of wealth per capita." And these differences between us—as regards the means by which alone the condition of the masses can be improved—are finally summarised by me in the statement: "Invention, increasing command over the forces of nature, can alone accomplish this. Schemes of distribution and strikes for higher nominal wages must end in failure and disappointment, so far as *the great masses of men are concerned.*"

In opposition to these three statements Mr. Ogilvy makes the following observations, to all of which I am sorry to give a categorical No!

(1) That "No increase of production can improve the condition of the masses unless accompanied by an increase of nominal wages."

(2) "In the primary industries, that is those concerned in extracting or producing the raw materials of wealth from the land (as in agriculture and mining), every increase of wages *will come out of the rent*;" and again, "Every department of industry (including carriers by sea and land) which is

concerned in supplying the raw material of wealth from the land, every enforced rise of wages will be clear gain to the labourer, because the loss will fall upon the landlord, *and stay there.*"

It is remarkable that Mr. Ogilvy's usual penetration should in these two propositions have so far failed him that he did not perceive that their support wholly rests upon old economic fallacies long since exploded, and discountenanced by the best, if not nearly all, modern economists. Even Mr. Henry George does not support these old economic fallacies, associated with "The Theory of Rent" and "The Wages Fund;" and yet, notwithstanding this, Mr. Ogilvy's conclusions regarding rent and wages depend wholly for support upon the resusicitation of those old fallacies which so long darkened men's minds regarding the true theory of rent, and the true relations between rent, profit, wages, production, and prices.

Theory of Rent.

"Ricardo's Law of Rent," now almost universally accepted by economists, is so well established by reason and experience that even Mr. Henry George is forced to admit that "its mere statement has all the force of a self-evident proposition." It is thus set forth, according to Ricardo:—

"*The rent of land is determined by the excess of its produce over that which the same application can secure from the least productive land in use.*"

Or, as stated more specifically by Mr. F. A. Walker:—

"*The rent of any piece of land is determined by the difference between its annual yield and that of the least productive land actually cultivated for the supply of the same market, under equal application of labour and capital.*" (P. 197, "Political Economy," London, 1887.)

If this be granted, we have the following distinguishing elements:—

Let R = Excess of Produce over that of the least Productive land actually cultivated for the supply of the same market under equal applications of Labour and Capital = Rent.

N = Produce of the least productive land actually cultivated under similar conditions to R.

C = Profit of Farmer and Capitalist.

W = Nominal Wages of Labourer.

P = Produce of Land, Labour, and Capital.

D = Demand of Consumers.

D^m = Maximum Purchasing Power of Consumer.

D^n = Minimum Purchasing Power of Consumer.

P^{rm} = Maximum Nominal Price of Products.

P^{rn} = Minimum Nominal Price of Products.

Then $R + N = P$ or Supply

$$\frac{C + W}{D^m} = P^{rm} \text{ or Price Maximum.}$$

$$\frac{C + W}{D^n} = P^{rn} \text{ or Price Minimum.}$$

Now it can be seen at once, if these premises be granted, that as the application or efforts of labour receive the same reward whether engaged upon the least (N), or most productive land in cultivation (R), that any alteration in the rate of wages, *if general*, would not affect the proportion falling to R, no matter whether the nominal wages rose or fell; for R (rent,) is solely determined by N, and—excepting cases where employment and area under cultivation are curtailed—is in no way concerned with the rate of wages. The *surplus, R (rent)*, has not come into existence as the sole work of labour; for in relation to the laws which determine price it is a measure of the gift of nature monopolised in the hands of landowners as rent. It is the fluctuations of demand (D) which directly affect the value of products coming to R, and not the scale of wages, whether high or low, so long as the scale is general. As about 52 per cent. of the breadwinners in various countries depend upon agriculture and pastoral industries, it is also clear that if the increase of their wages was only local, or partial, the condition of the great mass of workers would not be improved.

Going back to our analysis it follows that

$R + N = P$ or produce of land, labour, and capital
or = Supply.

Seeing that supply and demand are among the principal factors in determining price or nominal value in the market and as these are ever varying factors, it follows that nominal value or price ever fluctuates with the variations of (P) supply and demand (D). Thus—

$$\frac{R + N}{D} \text{ or } \frac{P}{D} = P^r \text{ or Price.}$$

But the actual cost of products being determined mainly by the cost of labour and machinery cannot fall below the actual aggregate cost of the standard of living for the labourer and the actual cost of maintaining the capitalist's machines and instruments.

On the other hand, the nominal value for products divided between R + G + W cannot be increased *much above* the minimum producing cost without operating upon demand

through the lowered purchasing power of the consumer, and so producing a check, or temporary equilibrium.

From this reasoning it follows that the surplus produce (R), while increasing the general store, and thus tending to lower prices to consumers, yet rent or earnings of landlords *per se* do not enter into the market price in any way, and therefore do not increase the price of products to consumer.

Therefore it follows that the ultimate exchange price, whether maximum or mimimum, is wholly determined thus :—

$$C + W \left\{ \begin{array}{l} + (D^m - D \\ - (D - D^n \end{array} \right\} = \left\{ \begin{array}{l} P^{rm} \\ P^{rn} \end{array} \right.$$

How, then, can any arbitrary increase or decrease of W affect R (rent), except in an indirect way, by its effect upon consumer, who certainly would have his real wages or purchasing power diminished correspondingly with any arbitrary increase to the *nominal wages* of W.

It can be shown, in a similar way, that the profit of the farmer, or entrepreneur, and the interest of Capitalists are determined solely by competition with each other, and are in no way affected by cost of machinery or wages of labour so long as these latter elements of cost are common to all competing farmers, entrepreneurs and capitalists. In all their enterprises *such charges* PLUS their own *profit* (solely determined by comparative skill, enterprise and competition) make up the final cost of products which *does not stay with the landlord or entrepreneurs*, but is passed on, and wholly borne by consumers; and therefore it is as *consumers* (not as landlords, farmers, entrepreneurs, capitalists or wage-earners) that all classes concerned in production are affected by any arbitrary increase to the nominal wages of the labourer.

These arguments, while demonstrating the accuracy of my original observation that "It is the *consumers* of *products or services* who would ultimately lose by the advantage gained by the industries whose wages were nominally raised, *and not the capitalists and employers* (as such) *who directly were obliged to advance the nominal wages,*" they also form a complete refutation of Mr. Ogilvy's opposing argument, tending to show that "*Every enforced rise of wages will be clear gain to the labourer, because the loss will fall upon the landlord, and stay there.*"

The fact that rent forms no part of the price of agricultural produce may startle many who have not given the matter deep consideration, and although affirmed by me as a truth, it must not be supposed that I take up a singular attitude in respect to this question : for it is the generally accepted opinion of the ablest economists and thinkers of the day. In proof of this I need only cite one witness, Mr. F. A. Walker, whose able work on Political Economy, published in

1887, deals so thoroughly with all vexed questions of this character. At page 200-201 ("Political Economy") he writes:—

"From the law of rent, as it has been stated, we deduce the very important conclusion that rent forms no part of the price of agricultural produce.

"No proposition which the political economist has occasion to announce is so startling, at the first hearing, as this; nor does any other contend against such persistent incredulity. And yet no proposition can be more clearly established."

Notwithstanding what has been said, it is quite possible, and has actually occurred recently to a large extent in England, that a rise of agricultural labourers' wages there, or what has the same effect, the opening up of large areas of more fertile land, as in America, or both together, may have the effect of throwing the poorer lands of any one place out of cultivation, and thus directly diminish the value of rent in that place. This is happening now, and for the last fifteen years in England, mainly by the influx of cheaper products from the distant vast plains of Dakota and other fertile areas of America. But what does this involve? Why, that for every 1,000 acres thrown out of crop cultivation, thereby diminishing rent, about 30 breadwinners, equal to 173 persons, are directly deprived of employment. This is the only way in which rent can be injuriously affected, but it is a process which is equally disastrous to the local agricultural labourer. It is also, on the other hand, advantageous to the consumer so long as these themselves do not form too large an element of the general population; for otherwise their cheapened foods of foreign creation might be more than counterbalanced by their diminished earnings as producers, and thus operate unfavourably upon their *purchasing power* or *real wages*.

But returning to the question of rent and price, it is clear, as affirmed by Mr. F. A. Walker, "That in the same market, at the same time, there is but one price for different equal portions of any (similar description) of commodity;" and "We have also seen that the normal price is fixed by the cost of producing *that portion of the supply* which is produced at the greatest disadvantage. Apply these principles to the case in hand. England does not raise all the wheat needed for the subsistence of her population (mainly mechanical and industrial). Besides cultivating the most fertile of her own fields she makes heavy draughts upon the United States, France, Egypt, Hungary, India, and the Black Sea region. For the wheat of all these countries, however, so far as it is of the same quality, *there is but one price*. That price is fixed by the cost of raising the million, say of bushels, which are raised at the greatest disadvantage, which means at the

greatest distance, viz., on the plains of Dakota." Wheat may be raised in Middlesex at an actual cost not exceeding two shillings per bushel; but the Middlesex farmer will not, on that account, sell his wheat below the market price, say six shillings (four shillings), which price is fixed, as we have seen, by the wheat from America. The difference, four shillings (two shillings?) is to be profit for somebody; and we will now proceed to show * that this body must be either the landlord or the tenant, not the agricultural labourer, and not the consumer of flour."

* As he afterwards does—p. 202.

To give a more explicit illustration of the probable effects of an increase in nominal rate of wages and of the process by which any increase in wages must fall upon consumers, and not upon rent of landlord, or the profit of the capitalist or entrepreneur—the following table is drawn up. And to throw further light upon the matter, let the points be discussed as if in diaologue between three persons, representing —landlord, builder and workman.

INCOME AND HOUSE RENT BEFORE AND AFTER A 20 PER CENT. RISE OF WAGES AND COST OF MATERIALS IN BUILDING TRADE.

—	Before Rise.			After Rise.			Amount of Net Increase or Decrease.		Per cent. Net Increase or Decrease.		Per-centage.
	Annual			Annual			Upon Income less Rent.		Upon Income less Rent.		
—	Gross Income	House Rent.	Income less Rent	Gross Income.	House Rent.	Income less Rent.	Increase.	Decrease.	Increase.	Decrease.	Actual Increase to House Rent.†
	£	£	£	£	£	£	£	£	P.C.	P.C.	—
Landlord‡	1,000	110	890	1,000	130	870	—	20	—	2·25	18·2
Building Contractor‡	500	85	415	500	100	400	—	15	—	3·0	17·6
Mason*	*125	*35	*90	*150	*40	*110	*20	—	*22·2	—	*14·3
Butcher‡	110	25	85	110	28	82	—	3	—	3·53	12·
Tailor‡	102	20	82	102	22	80	—	2	—	2·44	10·
Labourer‡, (not Builders'.)	90	18	72	90	20	70	—	2	—	2·77	11·1

† The land element of value in house rent is assumed as if not affected by rise in the wages and cost of materials in building trade, and therefore it does not show 20 per cent. increase on gross rental.

* Indicates the effect upon one of those who benefited by the rise in wages.

‡ Indicates the effect upon others.

Let us, then, suppose—as indicated in the preceding table—that all persons whose services are necessary to complete the building of dwelling houses (from the quarryman to the house painter and glazier) succeeded by a strike in having their wages or services raised 20 per cent. The question at issue between Mr. Ogilvy and myself is involved in the query:—Out of whose pockets would this 20 per cent. be derived?

Mr. Ogilvy adopts the view that it would come out of the pocket of the *capitalist* or *employer*; and I from a considerable practical experience in the building and letting of houses, gained during five years in a large city, affirm that it comes out of neither *employers nor wage-earners* as such, but out of the pockets of all persons who inhabit houses, *i.e.*, the *consumers* of houses so to speak. For let us take an instance of the process whereby the 20 per cent. increase ultimately comes to fall upon the *consumers of houses*, whether rich or poor, employer or employed, as it is attempted to be shown in the following imaginary dialogue between the three persons already referred to.

Dialogue between Landlord and Builder.

A.—*Capitalist*, a landlord of houses, deriving his income from investing his money in houses.

B.—*Employer*, a building contractor, who derives his income from his capital and plant and his directing skill as a builder and organiser.

A.—My dear *B*, I propose to build four additional dwelling-houses, similar to the four which you built for me for £1,600 two years ago : 1 at £500, 2 at £400, and 1 at £300 ; and I shall be obliged if you will give me an estimate of what you will now build four similar houses for me in the same locality.

B.—I shall be happy to do so, but you must be prepared to pay a higher price, as all building trade wages and materials have now gone up 20 per cent.

A.—What ? Do you mean to infer that I can afford to pay the extra 20 per cent. out of my pocket when my average profit hitherto at the old rates only yields me 5 per cent. on capital outlay in buildings, repairs, taxes and other necessary expenses in connection with letting, etc.? It is impossible !

B.—Well, there is no help for it. If you won't build others will; for as the population increase is not likely to be greatly affected for any length of time by the rise in the wages and materials of the building trade, more houses must be built by some one or other.

A.—That is all very true, but how can landlords afford to build houses at such prices at the old scale of rental ?

B.—Rental of buildings, not land rent, in all times and places, you are surely well enough aware, is determined by current rates and prices of land, labour, and materials, and not upon old rates of rental. You are no more called upon to let your houses at the old rates of rental than I am to contract for the building of houses at the old contract prices. In my profession we base our estimates

of costs, not upon the old rates, but upon what we infer the rates of wages, money, and materials will be on the average during the *time* and at the *place* where the new contract is to be carried out; and if you are to survive as a successful landlord you will have to be guided by the same unavoidable commercial principles.

A.—But that would only be done by making a corresponding increase in the rents of houses?

B.—Certainly. If competition hitherto among landlords obliged them to restrict their profits to 5 per cent. on capital outlay, the altered conditions of the labour market *affect them all alike*, so that all who do not become bankrupt must earn the same profit which competition among landlords themselves determined as a safe working minimum profit long before the recent rise of wages and materials came about. That means that rental of houses must bear the extra cost of building. Rents must be raised. The occupiers of houses must inevitably bear the burden of the increase, and as both you and I occupy houses we must also pay additional rent as occupiers of houses. But although we do expend more of our income as occupiers (*i.e.*, consumers) of houses, that cannot affect our income as derived from our business concerns as landlord and builder.

A.—Why so?

B.—Because the profits of either are determined, not by the wages, high or low, paid to workmen under them, *so long as they are general*, but upon the intensity of competition between employer and capitalist, and other employers or capitalists in the same business.

A.—But the workmen think that their higher rate of wages comes out of the "Wages Fund" of the older economists, and this is one of the reasons why they are so bitter against the employers or capitalists for absorbing, as they think, a too great share of the joint produce of labour and capital.

B.—The older economists are largely to blame for the present hostile attitude between the employer and his workmen; for undoubtedly this attitude is, in a great measure, based upon the mistaken notion that the increase in wages is an encroachment upon the employer's share of profit; whereas it is in reality an additional charge on the values of products affected, which is ultimately borne by the *consumers* of the particular products.

A.—But will the workmen be satisfied if they comprehend this matter in the light in which you regard it.

B.—Why should they complain? They have got their 20 per cent. increase. But if you are anxious to ascertain their views let us put the matter to the test by asking Jones the

Hewer, one of the most intelligent of my workmen, who is now approaching us.

A.—Good-day, Jones, I suppose you feel satisfied with the results of your strike contest, which has terminated so favourably for the workmen in your trade.

Jones.—Ah, sir! we are glad to have scored a success, but it has been at a bitter cost to all of us.

A.—But surely with 20 per cent. increase to your wages you ought to be fairly well satisfied.

Jones.—Oh, that's true enough, so far as the rate of wages is concerned, but trade is now in a very depressed state, and as a consequence many of our brother workmen are but half employed, and even if we were all fully employed at the better wages now ruling it would take fully ten months to cover our losses due to enforced idleness during the long bitter strike of nine weeks, which brought us all so much distress and misery.

A.—Ten months do you say?

Jones.—Yes, fully that, without mentioning the increased cost of living, now that the landlords are about to raise our rents by about £6 a year.

A.—I should like to hear how you account for your loss being so great that it should take so long a time at the present higher wages to cover it.

Jones—Oh, that's easily proved. Our nine weeks' idleness caused us a direct loss of £20 12s. 6d., reckoned at our old rate of 8s. 4d. a day, for 44 hours in the week. Our present wages are higher by 1s. 8d. a day (*viz.* 10s.), and it is easily reckoned that it will take 247½ days of that increase to make it good; and as we can only reckon 300 working days in the year it means the better part of ten months' earnings to put us straight.

A.—How do you account for so many of your men being still only half employed?

Jones.—Well, you see, the higher rents asked for the better class of houses are driving the poorer classes into the inferior houses that were formerly empty, and there is less demand than usual for new houses in consequence.

B.—Jones is quite correct there, as I know to my cost; for I have not had a third of the contracts this year, as compared with the average of the last three years, and my experience is also the experience of other builder contractors. But in my opinion there is another reason for the present slackness in the building trade.

A.—And what is that?

B.—I have long observed that statisticians are quite right in their statement that a sudden increase, however caused, in

the cost of living, has an immediate effect in checking, or, rather, postponing marriages ; and in no trade has this effect so immediately a depressing influence as upon the building trade.

A.—But things will take their natural course in time.

B.—True, but in the meantime our trade, whether for workmen or employers, suffers, and, as Jones has said, it will take a long time for the better state of things, when they do come about, to make good the losses of the present year of enforced idleness and its evil consequences to both employers and workmen. Employers now see, when it is too late, that it would have been better for employers and workmen had they approached each other at the outset of the strike in a more friendly way, instead of fighting it out to the bitter end of a nine weeks' struggle.

Jones.—I say aye to that, too.

A.—Then you, Jones, also think it was a mistake to enter upon this strike without a serious attempt to gain your cause by a more reasonable course ?

Jones.—Aye, sir, I do, and I have always been of the opinion that it would have been better to have settled our dispute by a friendly conference, even if it were to end in a compromise, rather than strike first and be obliged to confer when we were embittered by a long and cruel struggle for victory.

A.—And why, then, was the strike originated so suddenly without an earnest attempt to settle matters by a friendly council of conciliation ?

Jones.—Why ? You well enough know that the thoughtless, and those not burdened with the cares of a family, form the majority of workmen, and these are always too eager to enter a conflict without counting the bitter cost.

B.—The workmen are not singular in this respect, for the majority of employers at the outset were also too anxious to precipitate a conflict without proper consideration, and are also much to blame in their eagerness to fight out the struggle rather than compromise or make any honest attempt to approach the settlement of differences of opinion by conciliatory conferences. I, too, am comforted with the feeling that, although one of the minority of my class, I used all the influence I could exert to promote a friendly conference at the first ; but, as in Jones' experience, I and those who acted with me were over-ruled by the majority, who were too eager for conflict to give the matter the consideration that was necessary.

A.—Then both of you think that the strike might have been avoided with advantage to all ?

B.—Yes, I think so. We could have arrived at the same result had we discussed the matter fairly at the outset.

Jones.—I am sure we could if the same arguments on both sides were considered at the beginning of the dispute, and if we had an opportunity to discuss on even terms our misunderstandings of each other.

A.—Then both of you are of opinion that all future struggles of this kind in the various industries will be settled by friendly conferences rather than by lockouts or strikes.

B.—I fear not. The majority of men only see that the strike effected a rise of wages; and that will induce other trades to follow their evil example. The misery of the thing they do not consider. Nor do they perceive that the raising of wages if made general would cancel all the advantages gained by the first few industries who reaped the advantages of the wages increase; for the nominal increase in cost of living would then actually counteract all the advantages obtained by nominal increases to income.

A.—You have stated that before, but I confess I do not quite see how such a result comes about.

B.—It is, however, a matter the truth of which can easily be demonstrated by a simple process of reasoning, and I will try to make it clear to you. First let me assume, according to the modern course of exchange, that no element of the gratuitous gifts of nature, as such, enters into nominal values of products, and therefore the final nominal cost of all products and marketable satisfactions to consumers is solely determined or made up from the aggregate nominal cost of all the services engaged in the work of producing them. In this way it is obvious that the aggregate nominal value of all *wealth in exchange* or satisfactions would be exactly identical in nominal value to the nominal earnings of all persons engaged in producing them, whatever the nature of the services may be; whether organising and directing skill, wealth producing instruments, or the simple physical power of human bone or muscle. Any addition, therefore, to the nominal cost of production must correspondingly increase the aggregate nominal cost of products.

A.—I can follow you so far, although I confess I am not able to see as yet why the gratuitous gifts of nature should not be monopolised by some, and in this way come to be a charge upon products to consumers, without forming an item of expenditure of energy or capital on the part of the producer.

B.—Your observation is a very important one; for although upon another occasion I may discuss this point with you, I must ask you for the present to take it for granted, as an

assumption on my part, the truth of which may afterwards be discussed on its own merits.*

A.—Well, let us for the present admit this important assumption on your part, it still remains to be proved that no benefits would accrue to wage-earners if the nominal incomes of all the services of breadwinners, were equally increased.

B.—Yes, that is the point I desire to prove. But you must also bear in mind that it is the mere raising of the nominal rates of wages or incomes I refer to; for if by raising the rate of wages we could also correspondingly increase the number or actual quantity of products, my argument would completely fall to the ground.

A.—Yes, I perceive this, but I cannot myself see any indication of increased energy on the part of the great body of workmen who have had their wages raised.

B.—I am glad you admit this, for I can assure that so far as my business is concerned the amount of work performed per hour per man upon the whole remains unchanged.

A.—May not, however, the indirect effects of the improved condition of your workmen—giving them greater opportunities for self-improvement and greater power to improve the education of their children—result indirectly in promoting the spread of a higher culture and intelligence, and by this means increase the agencies at work which promote invention and discovery, and so multiply man's power over natural forces. For if this should be the outcome, our experience in the past shows that the satisfactions of life might be increased indefinitely without an additional tax upon the labourer's physical efforts or time, and without a very much larger expenditure of his income towards labour-saving instruments.

B.—I do not deny that something of this may be expected, providing the rise in wages is not general; but under any circumstances it must be infinitesimal; for *invention and discovery* spring from the *individual mind*, and have very little to do with the material condition of the individual, or a more comfortable state of life. The phrase, "Necessity is the mother of invention," has not come to be quoted as a world-wide phrase without some broad show of reason and truth; and this certainly does not encourage us in expecting a larger crop of inventors or discoverers from those whose condition has become more comfortable.

A.—This may be true, but surely you must admit that a greater spread of intelligence must broaden the sources from which inventive genius springs.

B.—Again, I repeat that I do not deny that this may have some influence; but I fear the mere attainment of a more

*See *Monopoly of the Gifts of Nature* ("Root Matters"—First series, pp. 31, 32).

comfortable state of existence among a section of our industrial classes would in itself have an infinitesimal influence upon invention, discovery, and increased energy. The new idea springs from the single mind, and not from the society or aggregate.

> " Men perished in winter winds till *one* smote fire . . .
> They gorged on flesh tell *one* sowed corn . . .
> They mowed and babbled till some tongue struck speech.
> What good gift have my brothers, but it came from
> Search, and strife, and loving sacrifice."

Professor Hearn had a clear perception of the conditions which determine invention when he wrote the following words :— *

"At every time and in every place the master of all arts and the bounteous bestower of genius is Want. It quickens the perception and sharpens the power of contrivance. This action is felt in every part of industry. There is scarcely one of the great improvements in the arts which has not immediately been connected with the expansion of some want. The want may be caused by the natural development of the capacities of the person by whom it is felt, or by the presence of some external obstacle. But whatever may be its origin, or whatever form it may assume, there is always a want, and a want of considerable persistence and intensity."

It was to strikes among workmen and the dearness or scarcity of skilled labour in America and in other countries that we mainly owe the origin of many ingenious labour-saving instruments, such as the cotton gin, the reaper and binder, and sewing machines. It was the craving for more leisure to play or scrog which led the boy Humphrey Potter to discover the first method for making the steam engine self-acting.

A.—It seems to me that the logic of your argument is to undervalue the results arising from improvements in the material condition of the people, and to magnify the influence of difficulties, obstacles, and want.

B.—You are no doubt in one sense justified in making this observation ; but remember it is restricted by me to the following questions :—What are the potent influences in promoting useful invention or discovery ? Do they spring more freely from men's minds when their material conditions are improved, or are they originated more frequently under the pressure of wants and difficulties. My own opinion tends to the conviction that the latter are the more potent influences.

In closing this imaginary dialogue, which might be greatly extended with advantage, let me now touch upon the

* P. 194. Plutology.—Extent of Invention—Circumstances which determine it.

question raised by Mr. Ogilvy as regards the relative personal consumption of wealth by rich and poor respectively.

Personal Consumption of Commodities by the Rich.

It is evident that Mr. Ogilvy had not bestowed his usual care upon the question concerning commodities consumed respectively by rich and poor, whether luxuries or necessaries. He has taken a very strange course in forming an opinion of the relative amount of consumption of goods by rich and poor from a superficial impression made on his mind by the showy displays seen in shop windows.

Rich articles are more fitted for attractive display as advertisments, but only the inattentive, or the unskilled, would ever dream of estimating, upon such evidence, the relative quantities and the relative aggregate values of goods held in stock for sale intended for the rich and poor respectively.

Although the gorgeous silks, satins, velvets, ribbons, and dress goods form the chief displays in the windows of establishments devoted to the sale of textile fabrics generally, they certainly form an infinitesimal part of the value, and a still more infinitesimal part of the weight of the general stock on shelves and in warehouses. This stands to reason; for it is well ascertained that all persons receiving upwards of £150 per annum—*i.e.*, under the annual average income of the skilled mechanic—only form about 2·28 per cent of the total population even in rich England. But a better plan would be to ascertain the value of these luxurious silks, satins, etc., as determined by the imports of a country whose principal supplies of textile fabrics come from foreign sources. Victoria is such a country, and an analysis of that colony's imports shows that scarcely 7 per cent. of the value of textile fabrics and dress are represented by the richer articles, such as silks, satins, ribbons, velvets, dress goods, and scarcely 1 per cent. of the weight of materials.

As regards *Food*, certainly not more than 5 per cent. can be set down as consumed by the rich personally, although their expenditure would be a little more than this if the consumption of their boarded servants were by error allowed to be included.

As regards *Luxuries*, again, it is remarkable that although we gave to all persons over £150 income the whole of luxurious articles imported represented by works of art, paintings, musical instruments, jewellery, and plated-ware, etc., it would not represent more than 7 per cent. of what the masses alone consume of *luxuries*, in the shape of drink and tobacco.

Again, as regards the consumption of the fruits of labour connected with the building trades, it is well to bear in mind

that 64 per cent. of the value and 92 per cent. of the number of all *dwelling houses* in Great Britain are connected with those (certainly not the rich) living in houses under £30 annual rental.

Although the nominal incomes of the rich appear to absorb a far greater proportion of the aggregate nominal earnings than their proportional numbers as units of the population, yet it must be borne in mind that a reference to the mere nominal incomes is a most deceptive guide as regards the individual consumption of the rich; for in the latter are aggregated much of the incomes of vast numbers of professional classes and domestic servants, which, being reckoned again and again as distinct incomes, although derived chiefly from the expenditure of the rich, make the nominal aggregate of the income of the rich and of total income enormously above the true net income of both the rich and the national aggregate. That is, the real incomes of *individuals* are counted over and over again, and thus falsify the true proportions of net personal income coming to rich and poor respectively.

In opposition to Mr. Ogilvy's statement, then, I may confidently repeat part of what I have already dealt with more fully in a former chapter of "Root Matters in Social and Economic Problems" regarding

Distribution and Consumption of Wealth.

Under this heading I have observed, "There are many fallacies current with respect to the creation and distribution of wealth. If all the enormous wealth year by year created by (1), stored fruits of previous labour (Capital—of which steam engines alone represent approximately the work of 1,000,000,000 men, or more than the physical energy devoted to the creation of fresh wealth, than double the working population of the earth), (2), current labour, and (3), the gratuitous forces of nature, were directly devoted to consumption or enjoyment, no doubt the proportion per head alloted to the industrial labourer would be small indeed in comparison with the rich."

But the human body, whether rich or poor, can only consume or assimilate a certain quantity of food per day. The old, sickly, and very young, cannot consume or assimilate as much as the strong healthy persons of youth and prime of life. Health and hard physical labour cause the body to burn more food, and the greater tear and waste consumes more weight of the products of the sheep and cotton plant just for the same reason as greater energy exhausted by a steam engine demands a much higher consumption of fuel and a much greater waste of parts in tear and wear.

From this reasoning it is almost conclusive that a strong healthy navvy can and does consume more weight of the products of the soil, of the flour mill and the weaver's loom, than the less robust city clerk or the brain worried financier; the mere quality or rarity of the materials involving more cost in some of the materials of the rich is comparatively insignificant and involves no more tax on the soil, on the capitalist's machines, nor on the workman's labour.

Further, it can be shown that if the steam engines alone of the capitalist perform more work than twice the number of the whole working population of the earth, and if these only form a part of his machinery, tools, and instruments, known vaguely or concealed under nominal values as "capital," it follows that the rich capitalist, or organising entrepreneur, cannot or does not abstract from his profits the same proportion of his income towards his personal wants and enjoyments as the workman does. On the contrary, what he can directly consume personally of the primary satisfactions which make up the bulk of consumable wealth is limited by the same natural laws as the humblest workman; and the necessities of repairing the tear and wear of his costly machines (real capital) or the passion or necessity to increase the number and power of his machines, and to protect and keep them ever at work, abstract the greater portion of his increasing or decreasing profits, which the thoughtless imagine are absorbed alto gether in personal consumption.

What is usually termed "The enormous accumulations of wealth in our times," "The riches of capitalists," do not consist of fine houses, luxurious equipages, money or grand parks, or if so, it only forms a most insignificant portion of it. The great bulk of the nominal and real wealth of capitalists consists of land improvements, mines, railways, tramways, ships, canals, stores, warehouses, manufactories, machines, tools and instruments, etc., themselves; and though rightly included in the aggregate wealth of a country by statisticians, these do not in any sense enter into the *personal consumption* of the rich owner any more than they enter into the personal consumption of the workman engaged in connection with these forms of national wealth.

The Fruits of Labour.

Familiar phrases, such as "The fruits of labour," "The toiling masses," "Man shall live by the sweat of his brow," "Capital is the fruit of labour," and such like, though correct enough as pleasing figures of speech, are too often wrested from their proper uses to adorn the fallacious arguments or rhetorical displays of well meaning, kind hearted people, in whom the logical faculty too often is easily overborne by

sentiment. Although I have a high appreciation of Mr. Ogilvy's logical acumen, I cannot help feeling that his enthusiasm and kind heart have, for the moment, dominated over his logical faculties when he spoke "of the lower ten millions whose toil is the *active factor that produces all wealth*, not of the upper ten thousand who *in some mysterious way* manage to get rich upon that toil." I am not disposed to quarrel with these words in so far as they convey the idea that their services (whether functional as accumulators of capital energy, or organising energy as entrepreneurs—man for man), absorb a very much larger share of the aggregate satisfactions produced than is ideally just or desirable. But this objection is merely one of degree, and is applicable to all persons between the earnings of the poor city girl of London, who has to wearily "stich, stitch" for dear life for 1s. a day, and the colossal earnings of a Vanderbilt. The following table may help to convey an idea how far *privilege* permeates throughout the whole range of human services, so far as *reward* bears any relation to either *time* or the amount of *muscular* energy expended:—

EARNINGS.

—	Average per day.	Per cent. Increase.	Average of Rich and Poor per day.	
			Above.	Below.
	s. d.		s. d.	s. d.
1. London Seamstress	1 0	—	—	4 6
2. English Agricultural Labourer...	2 0	100	—	3 6
3. Australian Labourer	6 0	200	0 6	—
4. Australian Carpenter	12 0	100	6 6	—
5. Average of the Rich Classes in England 3·3 per cent	40 0	233	35 6	—
6. Average of Rich and Poor ...	5 6	—	—	—

This proves that the total income of rich and poor—in one of the richest countries of the world (United Kingdom, £1,250,000,000)—only averages 5s. 6d. per day per bread-winner, and that all those who earn over that rate per day really belong to the "privileged classes;" for even the common labourer of Australia at 6s. per day receives 9 per cent. above the *level of equality*, which, if once attained, so many vainly dream would procure them a vast addition to their present allotted share in the distribution of wealth. The Australasian carpenter actually receives a higher relative rate of income (not a greater absolute difference, however,) above the London seamstress (viz., 1100 per cent.) than is the average rate of the rich (3·3 per cent of population) above that of the Australasian carpenter—being only 233 per cent. higher.

It follows clearly from this that strikes for higher wages among those who already earn above the *standard level* of 5s. 6d. per day cannot justify their claims by the appeal indicated by Mr. Ogilvy that it "is a movement of the underpaid against the overpaid." It is not a fact. So far as the majority is concerned, it really would be a *movement of the overpaid against the underpaid*, or more specifically, it would be a movement of the lower grade of the privileged classes against the masses forming the unprivileged, *i.e.*, all those whose earnings are now below 5s. 6d. a day, or the standard level of equality. Nor can the lower grade of the privileged classes contend with justice that their higher wages are in proportion to greater expenditure of *time or muscular energy*. On the contrary it can be easily demonstrated that the lowly paid agricultural labourer or common lumper expends far more of his time and muscular energy than the better-paid carpenter, engine fitter, or mason.

Active Agents in the Production of Wealth.

Finally let us examine what truth there may be in Mr. Ogilvy's statement in which he leads us to infer that the "toil" of "the masses," "the lower 10 millions," alone "*is the active factor that produces all wealth.*" Entertaining such a view, it is not remarkable that Mr. Ogilvy should regard the riches of the "upper 10 thousand" as a hoard mysteriously and wrongfully abstracted from the forces actively engaged in producing wealth.

If by the toil of the masses he means that *all the physical forces* requisite to transport and transform natural materials to suit the needs of man, he is manifestly wrong. For (exclusive of the more gratuitous forces of nature, such as natural chemical changes, multiplication by the mysterious forces of life, sunlight and heat forces, gravitation, the rain, dew and the fertile soils, and the animal, vegetable, and mineral products in their natural state and position) there are the active forces set in motion—not of the expenditure of muscular energy—but of mental and moral force, exerted by men of forethought, of skill, of invention, and of the provident who designedly saved from immediate personal consumption and devoted such savings purposely to the construction of mechanical and other aids, devised or discovered by skilled minds, whereby the *forces of nature*, such as gravitation, chemistry, steam, water, wind, electricity, leverage, lower animals are so captured, tamed, and drilled, that they now exert a physical force in the production of man's wealth—whether in the way of transporting from place to place, or in transforming materials from the natural raw state to the highly finished—compared with which the *brute*

or muscular force actually exerted by all the working men of the globe forms the most insignificant fraction.

I have already pointed out that it is estimated that the steam engines alone now engaged actively in the production of man's real and nominal wealth represent double the *potential muscular force of all men in the world* at the present time, exceeding the *muscular force of men actually engaged* in the production of man's wealth by, perhaps, three or four times. The mere muscular pressure of a man, which, on his part, only exhausts his muscular energy by what would be equivalent to the movement of his body by one step, may, and in fact now incessantly does liberate and set in motion a transporting force in one machine equal to the combined total muscular force of from 200,000 to 500,000 men.

At the present moment on the railways of Pennsylvania, in America, *a single engine* conveys a load of 1,500 tons 29,927 miles in one year. It would, in a primitive stage, say by the strong African carriers of Stanley, take the mere muscular force of 465,360 men, carrying 60lb., and travelling at the rate of 12 miles per day, to accomplish the same work in the same time; and even though they only received wages at the rate of 1s. per day, it would cost £6,980,400; at 5s. per day it would cost £34,902,000. The single Pennsylvanian engine, however, carries the same load, viz., 1,500 tons, 29,927 miles within one year for the sum of £92,721, or $\frac{1}{2}$d. per ton per mile. That is, a single modern locomotive exerts as much wealth-producing energy as could be effected by the whole muscular force of 465,360 strong men, and at $\frac{1}{376}$ of the nominal cost. Even if we went into refinements, and attempted to abstract the human *muscular energy* expended in the manufacture of the engine from raw materials, and the consumption of stores and materials consumed in the work, also partly the produce of the muscular force of man, it would be more than covered by the subtraction of the muscular energy of 600 men, leaving still to the credit of the single machine a balance of natural physical wealth-producing energy, *i.e.*, *non-muscular*, equivalent to the *muscular* energy expended of 464,960 powerful men during one year.

When in addition we think of the Spinning Jenny, the electric telegraph, the sewing machine, and the thousand complicated forms of machinery—such as the Naismith Polka Hammer, which by the slight pressure upon a handle a small boy can instantaneously pour 100 ton blows upon ductile masses of iron—we can have some faint conception of the immense mechanical and natural forces ever at work in civilised countries—outside of the muscular force exerted by man—and contributing its giant share of the physical agencies

which give commercial value to man's wealth.* It is clear therefore that nothing can be further from the truth than the assumption by Mr. Ogilvy that the energy of "the lower ten millions" or the "masses" alone represent the active factor that produces all wealth.

The brains of man can alone be credited with invention and discovery, not his muscular power. It is to the accumulations of savings from personal consumption by the labourers of former times that we are indebted for the stores devoted to the construction of the powerful mechanical and other auxiliaries now engaged in aiding the current labour of men, and not, as falsely assumed, to the mere energy exerted by those who happen to be the labourers or workmen of the present moment.

The large body of the capitalists of to-day are, broadly speaking, really the natural descendants and inheritors of the *savings* of former workmen, who not merely *worked* but *saved;* and it is specially because of the *savings* of former workers that we have now a vast accumulation of *capital* invested in labour-saving appliances, and in works of permanent utility to all men, and not generally because those who *saved* were indebted to labour for their savings. All labourers in the past, as well as in the present, did or do not accumulate savings, and the descendants of those *who did not save* have no just claim to the capital or accumulated savings now largely in the possession of those who saved, or their natural descendants.

Of course the children of the former savers of capital are thereby now often raised above the social scale of their fathers. But this is natural; for it must not be forgotten that the affection and solicitude of parents for their children are ever the active motive forces which induce parents to sacrifice present personal gratification, and to save up in order that their children may enjoy a larger amount of the world's material satisfactions than their parents permitted themselves to afford out of the fruit of their own labours. Take away this powerful motive and you destroy the main source of the savings which make capital accumulation a possibility. Capital wealth, therefore, has not been wrongly abstracted from the labourer as such. It is a real addition to the world's power and wealth, solely built out of the savings of those who providently abstained from consuming at the time the whole of the fruits of the labour to which they were entitled, which otherwise would have been as much lost to the world as if it had been destroyed by fire.

* See also p. 40-44 Root Problems, 1st series, which also demonstrates that "Improvement in the Condition of the Individual is largely due to the Savings of Anterior Labour (capital) skilfully applied as instruments aiding Production."

It is not because *nominal wages* are much higher to-day in Australasia than at the close of the sixteenth century in Europe that the present workman is so much better off in every way than his predecessor of three hundred years ago, but mainly because of the great increase of capital wealth invested in labour-saving appliances, whereby the annual wealth created for consumption and *real wages* or purchasing-power over wealth have so improved that the workman of Australia can, by the expenditure of $4\frac{1}{3}$ days' labour, command a much larger share of the world's wealth or satisfactions than could be done by the accumulated savings of $40\frac{1}{4}$ days' labour amidst the dirt, discomfort, and almost enslaved condition of the labourer 300 years ago.

I think Mr. Ogilvy's objections to my former paper on strikes have been shown by these observations to be based upon assumptions which cannot be sustained when subjected to close scrutiny, and I can only re-affirm that it is by increase of *savings* properly applied in the creation of instruments which will still more greatly multiply the powers of man that any marked improvement to the condition of the masses can be successful. Without this the mere raising of wages can only benefit a few industries at the expense of the many.

Discussion.

Mr. Ogilvy said that Mr. Johnston had rather drifted into the ethics of the question, which were expressly excluded in his paper, and discussion confined to the question whether strikes, as a matter of fact, really improved the condition of the masses. He had tried to show that they did, and Mr. Johnston had tried to show that they did not. It was for the members to judge. Mr. Johnston had based his argument principally on the theory of Ricardo, but he differed with him in thinking that that authority had expressed the whole theory of rent. Although later economists had adopted it, the British Parliament had virtually repudiated the theory by the establishment of Land Courts in the Highlands of Scotland, and in Ireland, thus introducing an artificial element into what was held by some economists to be a natural law. In regard to what Mr. Johnston said about the rent forming a part of the price of agricultural produce, there were some farmers present, and he asked them if they had to pay twice as much as they now did for their labour could they afford to pay as much rent?

Mr. W. E. Shoobridge said that there were two points which occurred to his mind. One was that the actual amount of wages was not so much the question as that of facility of exchange. Mr. Johnston had pointed out in his original

paper, and he agreed with him, that it was not the actual amount of wages paid that benefited the workman, but the satisfactions that could be procured by the results of the labour of the workman. Mr. Johnston had shown what was an undoubted fact, that owing to increased production the working man was able now to get better satisfaction of his wants with his wages than was the case a few years ago. He attributed the origin of strikes to the combination in the first place of capital, which ruled prices. Of late years, through the improved condition of labour, some of the labourers had been able to make savings which accumulated so that they could do for a certain time without actual labour. They were, therefore, to a certain extent capitalists, and by combining they had been able to demand their own terms. He thought that this was the secret of the source and success of all strikes. There was no question but that the product of individual labour had greatly increased, but the question was how this increased product was to be divided if it was the case that, owing to the combination of capital, the amount paid by the consumer was too great in proportion to the amount paid to the labourer. This was a difficult question, but he hoped that it would be settled in the future without resorting to such barbarous methods as strikes. He considered that the main question at issue was whether it was possible by the present appliances to produce a great deal more of the articles necessary for life and comfort than was produced previously; if so, by labourers having the means of getting a larger share in the products their condition would undoubtedly be improved.

NOTES ON A NEW TASMANIAN PLANT OF THE ORDER BURMANNIACEÆ.

By Baron Ferd. Von Mueller, K.C.M.G., M.D., Ph.D., F.R.S.

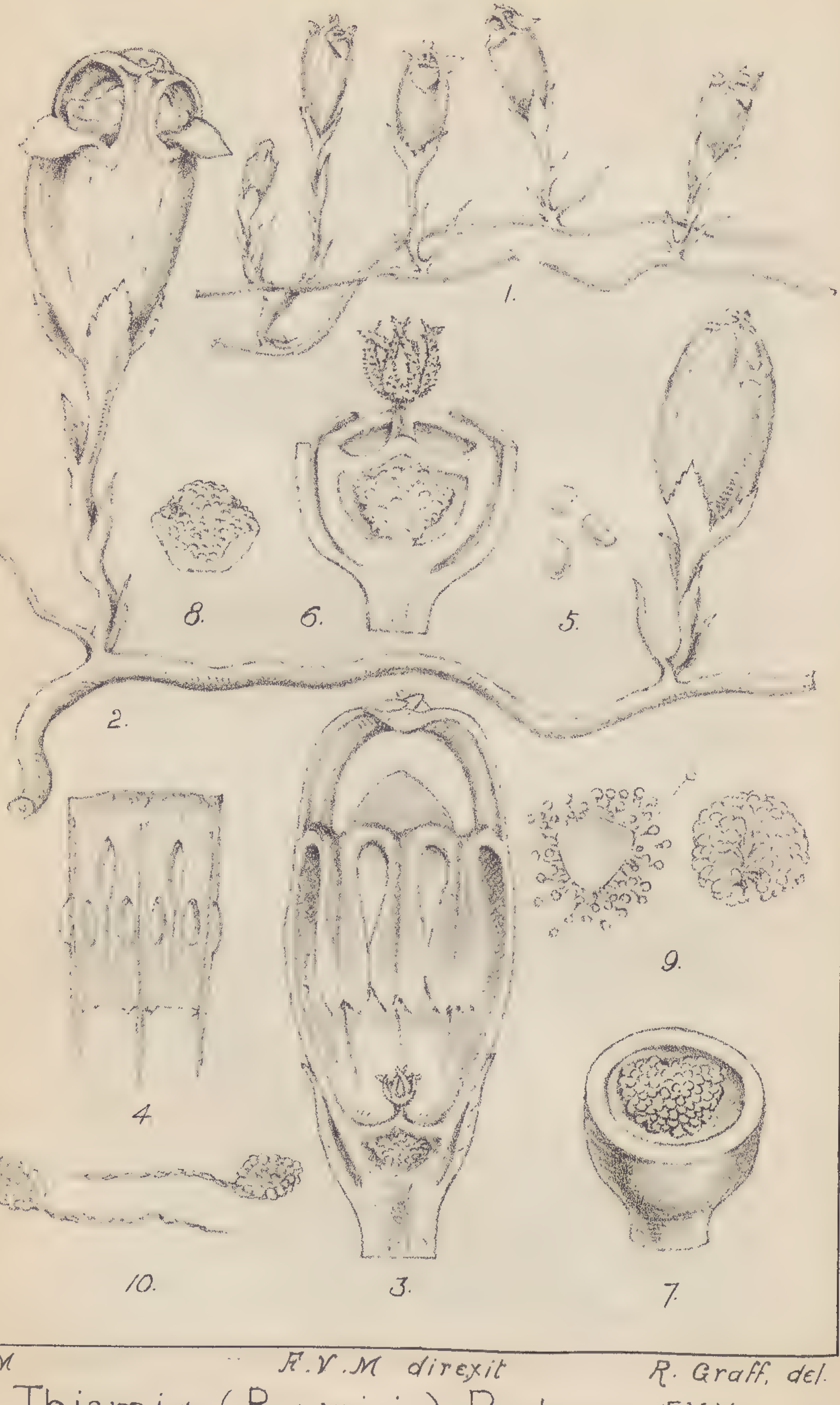
In the early part of November 1890 my attention was directed, by a letter from Mr. L. Rodway, of Hobart, to his discovery of a remarkable plant, parasitic on the extreme roots of Aster argophyllus, and from his notes it was evident that this plant would at all events be new for the records of the indigenous vegetation of Tasmania. But as the plant was of fugitive growth and deliquescent structure, no specimens were in the first instance secured or preserved. On my particular request the search was very patiently renewed with the result of one more specimen being procured, well developed, and another bearing an unexpanded flower. These arrived in a good state of preservation, being carefully packed between the fresh leaves of some tender grass. Much to my astonishment I perceived that this long hidden floral treasure was a species of Thismia, of which genus (in its widest sense) as yet some few species are known from southern continental Asia, Ceylon, the Sunda-Islands, New Guinea and tropical South America. On careful dissection the Tasmanian congener proved very distinct from all others. Thus, then, we became suddenly acquainted with a member of this otherwise intra-tropical genus from the remotest southern part of the Australian dominions, from whence indeed this would have been least expected; nevertheless, the order of Burmanniaceæ is represented by one species of the typical genus, namely Burmannia disticha, down to a very far southern position in New South Wales, and also just outside the tropics from Nepal, while another, B. biflora, advances northward to Virginia, and a species of Apteria, A. setacea, gains its northern boundary in Florida.

Before offering any further general observations, I shall detail descriptively the characteristics of the co-ordinal Tasmanian plant.

Thismia Rodwayi.

(Bagnisia Rodwayi, F.v.M., m.s.c.)

Stem to about two inches long, flexuous, colourless, like all other parts of the plant glabrous; leaves scattered, rudimentary bractlike, semilanceolar, acuminate, devoid of colour; flower solitary, terminal, of putrid odour, closely supported by a much shorter involucre of three appressed equidistant semilanceolar bracts; calyx about $\frac{2}{3}$ inch long, somewhat



T.M F.V.M direxit R. Graff, del.

Thismia (Bagnisia) - Rodway! F.V.M

1.... Plant, natural size.

2.... Plant, enlarged size.

3.... Longitudinal Section of a flower.

4.... Part of the staminal column, rerersed.

5.... Pollen grains, very much enlarged.

6.... Longitudinal section of a young fruit.

7.... Transverse section of a young fruit.

8.... Placentaries & orules., the funicles concealed.

9.... Front & Back view of orules & funicles.

10.... Young Seeds with funicles.

"Mercury" Litho.

succulent, ovate-campanulate, flesh-coloured, streaked by six stronger and six fainter longitudinal colourations; its six lobes much shorter than the tube, three semilanceolar-deltoid, spreading, much the shortest; three opposite to the bracts, nearly ovate-cuneate, converging, at the summit overlapping and there connate, keeled by a broadish, flattened, slightly excurrent midline; stamens six, opposite to the calyx-lobes; filaments broad, from the place of affixion near the summit of the calyx-tube slightly ascending, there dark-red and somewhat channelled; thence suddenly bent downward inside the calyx and connate; continued beyond the anthers into a dilated membraneous bidenticulated appendage; anthers pale, their two cells parallel, ellipsoid, slightly distant from each other, longitudinally dehiscent; style short, whitish, thinly cylindrical; stigmas three, colourless, short-bifid; ovulary adnate to the base of the calyx, one-celled, devoid of colour, almost hemispheric, excavatedly depressed at the surface; placentaries three, nearly cordate; ovules very numerous, on conspicuous funicles arising from the whole face of the placentary, provided around with an ample laxe pellucid integument of equal breadth. Complete roots and ripe fruit not yet obtained. In examining the quickly perishable and scanty material, I missed ascertaining the form of the pollen-grains, also determining the relative outer and inner position of the calyx-lobes, regarding which Miers however offers observations on Myostoma already. The rootlet, on which the plant grew bear many pyriform small carnulent short-stalked bodies, somewhat hollow.

That so remarkable, and to some extent also showy plant should have evaded hitherto observation, although since almost nearly 100 years the region about the estuary of the Derwent has been searched for plants, finds perhaps its explanation in the fact, that in all likelihood the flower only is peeping above the soil between decaying foliage, and thus might be easily taken for a young Aseroe or some other fungus, especially as the smell would lead also to that conclusion. Furthermore, each flower must be very ephemerous and perishable, and falls probably also quickly to the prey of various insects, attracted by the odour. Even in Europe the Epipogum Gmelini is often overlooked, when it merely emerges among rotten Fagus-leaves, particularly as the flowers are not high-coloured.

After now, through Mr. Rodway's circumspectness, the Tasmanian Thismia became not only known, but also its manner of growth elucidated, it will likely be found in other places of the island there, perhaps also in New Zealand and in Continental Australia. It should further be ascertained, whether it lives exclusively on the roots of the Musk-Aster, or whether it is nourished also by the roots of any other plants.

How restricted some parasites are in this respect is demonstrated in Tasmania and Victoria by the Cyttaria Gunnii, which never occurs on any other tree than Fagus Cunninghami, all other Cyttarias occurring also only on Beech-trees.

For Australian phytogeography the finding of a Thismia, not as might have been looked for in North-Eastern Australia, but in such an extreme extratropic isolation, is one of the most remarkable additions to our recent knowledge in this direction. But the discovery of this plant is also in other respects of special interest, because it shows that the genera Geomitra and Bagnisia should be united with Thismia, the merging of Geomitra into Bagnisia having already (1883) been advised by Bentham and Hooker, a view acted on by Engler in the "Pflanzen-Familien," 21 Lief. p. 48 (1888). Those who prefer smaller genera for systematic arrangements against more natural and more easily employed larger genera with subdivisions, might assign to our new plant even generic rank, then as Rodwaya, but such a separation would mainly rest on the reduction of three of the calyx-lobes to extreme minuteness, and on the coalescence of the tips of the longer calyx-lobes somewhat in the manner of the Southwellias within the otherwise far disallied genus Sterculia; in typical Thismia the lobes are perfectly disunited, much differing as regards form in various species, while in Bagnisia and Geomitra they are variously united. Adopting all these plants for one generic group, we would obtain chiefly chronologically the following arrangement, so far as the species are hitherto known; but their series will likely in the course of time receive considerable augmentation yet.

1. *Thismia Brunoniana;* Griffith in the transact. of the Linnean Soc. xix., 341-344 t. 39 (1844). Tenasserim.

2. *Thismia Gardneriana;* J. Hooker in Thwaites enum. plant. Zeylan. 325 (1864). Ceylon.

3. *Thismia Macahensis;* Bentham and J. Hooker, gen. plant. iii., 459 (1883) implied.

   Ophiomeris Macahensis; Miers in transact. Linn. Soc. xx., 374-379, t. 15 (1847). Rio de Janeiro.

This and the closely allied O. Ignassuensis (Miers l.c.) have an obliquely bulging calyx, free stamens, bicaudulate-filaments and upwards converging anther-cells, so that the genus Ophiomeris, against the views of B. and H. might perhaps be kept up.

4. *Thismia hyalina;* Bentham and J. Hooker, gen. plant. iii., 459 (1883) implied.

   Myostoma hyalinum; Miers in transact., Linn. Soc. xxv., 474-475 t. 17 (1866). Organ-Mountains.

This again might generically be held apart on account of the disconnected stamens with free very thin filaments and sagitate anther-connective, particularly so, should no transits to these characters be discovered in any yet unknown species.

5. *Thismia clandestina;* Sarcosiphon clandestinum; Blume Mus. bot. Lugd. Batav. i., 65 t. xviii. (1849) Java.

Imperfectly known, and therefore the generic place doubtful.

6. *Thismia Neptunis;* Beccari, Malesia i., 251 t. xi. (1878). Sarawak.
7. *Thismia Aseroe;* Beccari, Malesia i., 252 t. x. (1878). Singapore.

To this stands evidently in closest relation the simultaneously described and figured Thismia ophiuris from Borneo.

8. *Thismia clavigera.* Geomitra clavigera; Beccari, Malaisia I, 251, t. x (1878). Sarawak.
9. *Thismia episcopalis;* Geomitra episcopalis; Beccari, Malaisia i., 250 t. xi. (1878). Mt. Mattan, Borneo.
10. *Thismia Rodwayi;* Derwent, Tasmania.

This is nearest allied to the next foregoing.

The constitution of the word Thismia, as dedicatory to the Phyto-Anatomist Th. Smith, was unfortunate, though the name is euphonious.

Soon after this was written, several more specimens of the Thismia were found by Mr. Rodway and kindly transmitted to me; they came from the lower portion of the eastern slope of Mount Wellington. He noticed the plant to grow also on the roots of Bedfordia, and he further ascertained that the unpleasant odour of the flower is only developed in the process of decay. Root ramified into few filiform somewhat carnulent divisions. Stem one, or when two stems occur, distant, sometimes very short. The three shorter lobes of the calyx exterior, but at about the same level as the longer lobes, which can be regarded as petaline. Anthers concealed through the introflexion of the staminal tube, whereby they are pressed against the inside of the calyx-tube, so that intervening of insects becomes necessary for passing the pollen on to the stigmas. Outer part of the anther-connective ending upwards in two deltoid denticles, much overreached by an exceedingly tender setule. Pollen grains whitish when moist, almost dimidiate globular. Ripe fruit as yet unknown.

ON NEW SPECIES OF TASMANIAN ARANIEDÆ.

By A. T. Urquhart,
Corresponding Member of the Royal Society of Tasmania.

Fam. EPEIRIDÆ.

Gen. Epeira, Walck.

Epeira Mortoni, sp. nov. Plate. Fig. 1.

Femina.—Ceph. th., long, 4·8; broad, 4; facial index, 2. Abd., long, 10; broad, 6; legs, 1, 4, 2, 3 = 19, 14, 17·5, 10 mm.

Cephalothorax fulvus, greenish tinge, lake-brown reflections on cephalic part and lateral margins, fovea deeper shade; hairs white, silky, adpressed; slightly surpasses tibiæ of first leg in length; moderately depressed; pars cephalica depressedly convex, truncation visibly rounded, ocular eminence slight; lateral index equals two-thirds of facial; depth of *clypeus* scarcely equal to three-fourths diameter of an anterior centre eye; sides of pars thoracica well rounded; fovea large, sub-oval, longitudinal; caput and radial striæ slightly defined; profile-contour rises from thoracic junction at an angle of 30deg., slopes moderately across caput.

Fore and hind row of eyes tolerably and somewhat evenly recurved; fore-centrals of equal size; posterior, median-pair posited obliquely on dark, oval, prominent spots, separated by an interval equal to an eye's breadth and a half, scarcely their space and one-half from laterals; anterior centre eyes visibly more distant from each other than they are from hind pair, an interval rather exceeding their diameter; their space and a quarter from side eyes; laterals about one-third smaller than centrals, seated obliquely, more than half their radius apart, on separate tubercular eminences.

Legs fulvus, femora of two-first pairs reddish-brown, annuli reddish-fuscous; distal rings on femoral joints; central and apical on tibiæ and metatarsi; second half of tarsi shade off to dark brown; hairs dark, somewhat sparse; spines brown or black, numerous, irregular.

Palpi fulvus, fore-end of pars digitalis fuscous; hairs light; well spined; moderately long and slender.

Falces brownish-yellow, fangs dark; conical, vertical, flatly convex, length equals breadth of anterior row of eyes, their space visibly surpasses it.

Maxillæ fulvus, fuscous clouding; length perceptibly ex-

ceeds their breadth, much dilated at extremity, roundly pointed, inclined towards each other.

Labium darker than maxillæ; nearly as long as wide, conical.

Sturnum mahogany-brown, cordate, moderately developed eminences opposite coxæ.

Abdomen elongate-oviform, moderately convex above, sides steep, longitudinally wrinkled; base produced into two sub-conical elevations; deep lake-colour, with brownish penetrative tints, markings creamy-white; dorsal area displays two wide, sinuate, converging bands, extending from the rounded face of basal humps to second half of dorsum, enclosing a cunate area, where they are resolved into a series of more or less defined spots terminating at anus; side stripes broad, sinuate, compressed somewhat forwards, interrupted at the nearly free spots contiguous to base of humps; between the latter is a somewhat V-shaped mark, extremities dilated, central spot; this figure is followed by several more or less pronounced dots on median line of cunate area; the more strongly defined impressed spots occur on fore-half; anterior pair placed between humps, form a quadrilateral figure with second pair, longer than broad; latter pair included in the transverse line of four spots, which cause a constriction in each of the converging bands; central pair indent extremity of these bands, represent with second pair a trapezoid narrowest in front; lateral margins clouded with lake-black, display on superior line and interrupted border, resolved into spots; ventral shield, olive-green, passing into a brown on median line, margin, yellowish, elongate oval; *vulva* light greenish-yellow; wrinkled, subconical, prolonged into a remarkably long vermiform stylus, yellowish, two fore-thirds blackish, somewhat incrassated and depressed towards second half, sharply bent forwards, rapidly curved backwards; posterior face of corpus vulvæ displays a dark rimmed oval area, enclosed within is a fuscous plano-convex spot.

Var. a, *Cephalathorax* galbious, dorsum of caput and median band reddish brown, lateral margin fuscous. *Legs* galbious, femora of I. and II. suffused with brown-black, annuli broad, fuscous. Colouration of palpi lighter than legs. Pattern and colours of *abdomen* do not differ from type-form, except that the lake approximates more or less to a deep brownish-purple.

I have much pleasure in naming this handsome species after Mr. Alex. Morton, Curator of the Tasmanian Museum, to whom I am indebted for a large collection of spiders.

Epeira ventriosa, sp. nov.

Femina.—Ceph. th., long, 5·7; wide, 4·5. Abd., long, 12; wide, 11; legs, 1, 2—4, 3 = 22, 20, 13 mm.

Cephalothorax lake-brown, passing into brown on posterior incline and lateral borders, moderately clothed with adpressed, silky, whitish hairs; depressed; length equals metatarsus and tarsus of a leg of fourth pair; pars cephalica sub-aplanate, squarely truncated, ocular-eminence prominent; facial index exceeds lateral by one-fourth, equals one-half breadth of thorax; depth of *clypeus* plainly surpasses diameter of a fore-centre eye; pars thoracica ovate; indentation trisected; caput and radial striæ faint; contour of profile represents a moderate, even arch.

Fore-centre *eyes* of about equal size, form a quadrilateral figure widest in front; posterior row slightly recurved, median eyes rather further from fore-pair than they are from each other, an interval visibly surpassing their diameter; their space and a half from laterals; curvature of anterior row perceptibly stronger than hind row; median eyes separated by an eye's breadth and a half, divided from side-eyes by their space and a quarter; laterals one-third smaller than centrals, posited obliquely on a forward projecting tubercular elevation, less than their radius from each other.

Legs and cephalothorax concolorous, annulations broad, brown, not clearly defined; hairs fine, somewhat sparse; spines yellowish, base dark; fairly numerous, irregular; tibial spines equal to its own diameter in length; legs moderately stout, tibial joints cylindrical.

Palpi fuscous, annuli deeper tone; length equal to metatarsus and tarsus of first leg; spines numerous on radial and digital joints; palpal claw short, well curved, 9 teeth, 3 basal rapidly decreasing in size.

Falces deep, raw-sienna; conical, vertical, strongly gibbous at base in front; fore-third divergent, as stout as the femur of a third leg, length equal to anterior row of eyes; 4 teeth on outer row; inner 3.

Maxillæ nearly as broad as long, extremity much dilated, roundly pointed, inclined over *labium,* which is wider than long, sub-triangular; organs olive-brown, pale margins.

Sternum mahogany-brown; hairs light; cordate; eminences opposite coxal joints.

Abdomen broad-oviform, base pointed; profile-contour ovate; humeral tubercles obtuse-conical; rather sparsely clothed with short, black bristle-like hairs, and soft white, latter following the lighter tints; pattern somewhat obscure; ground colour creamy-brown, mottled, ill-defined patches of a pale olive-brown, few orange-red stains, most pronounced about region of centre figure and tubercles; basal half displays an olive-brown cruciate figure, composed of two longitudinally placed, spindle-shaped spots, and two much

smaller lateral spots in line with tubercles; lateral margins show a series of chocolate-brown rib-like streaks, convexities directed backwards; basal end displays a series of fine horizontal streaks, limited by first rib-like line; ventral surface chocolate-brown; shield pale burnt-sienna, large, brown, trapezoidal mark in centre; spinners short; *corpus vulvæ* lake-brown; sub-reniform, of moderate size; sides abrubt, project outwards; face bordered by two narrow costæ, inner black, encloses a heart-shaped area containing two foveæ, divided by a longitudinal groove; apex of area limited by the rima genitalis; springing from anterior border of corpus is a long, tapering, flat, transversely rugose, hairy, yellowish scapus, curving backwards and upwards.

Single specimen. A.M.

Epeira notacephala, sp. nov.

Femina.—Ceph. th., long, 4; broad, 3; facial index, 1·5. Abd., long, 5; broad, 4. Legs, 1, 2, 4, 3 = 12·5, 11·5, 11, 7 mm.

Cephalothorax light brownish-orange, reddish dots, two fuscous spots transversely posited in centre of caput; thoracic part displays two rows 6—2 of similar tinted spots; hind and fore-centre pair enclose a V-shaped figure within fovea. This figure is connected by short bars with next pair of spots in anterior row; marginal band brown, projects a triangular mark on basal half, fades away forwards; fairly-well clothed with rather coarse, whitish, adpressed hairs; length equal to metatarsus and tarsus of a leg of first pair; pars cephalica sub-aplanate, sides abrupt, somewhat retreating; lateral index equals space between a fore-lateral eye and the central furthest from it; depth of *clypeus* equals diameter of a fore-centre eye; pars thoracica oval, convex, fovea sub-circular, shallow; normal grooves faint; profile-contour represents a somewhat prominent arch, cephalic and thoracic incline of about equal grade.

Eyes of fair size, placed on fuscous rings; posterior row perceptibly recurved; median pair visibly more than an eye's breadth apart, their space and one-third from laterals of same row; anterior row more distinctly recurved; centrals one-third larger than hind pair, perceptibly closer to these eyes than they are to each other, an interval surpassing their diameter by one-fourth; divided from side eyes by rather less than two-thirds their space; laterals scarcely one-third smaller than posterior centrals on fuscous rings, oblique, about two-thirds their radius from each other; fore-eye posited on a yellowish projecting tubercle.

Legs pale yellowish stone-colour, fuscous patches and spots on inferior side of femoral and coxal joints, indications of annuli

on metatarsi; tarsi shade off rapidly into reddish-fuscous; hairs pale-yellow; spines yellowish, dark base; fine; tibial shorter than transverse diameter of article, numerous; tibiæ of I. and II. have on inferior side a double row of 5, 5; metatarsi 4, 3; legs moderately strong; II. and IV. of about equal length; patellæ and tibiæ compressed, grooves slight; superior tarsal claws—1st pair, 9 comb teeth; inferior claw 2 points.

Palpi colour and armature of legs; length, 4·6 mm.; palpal claw well curved, 10 comb teeth, 2 basal small.

Falces fulvus, glossy, apices brownish; conical, base in front gibbous, vertical, slightly exceed pars digitalis of palpus in length, as stout as the femur of a first leg; double row of black teeth, outer 4, inner 3.

Maxillæ greenish-yellow, centre clouded with light-brown, rather longer than broad, enlarged forwards, obtusely pointed, inclined towards each other.

Labium pale greenish-yellow, base fuscous, wider than long, triangular.

Sturnum light-brown, passing into dark chestnut-brown on margins, spotted; cordate, eminences opposite coxal joints.

Abdomen sub-triangular, base truncated, depressed, humeral tubercles well developed, conical apices brownish, semi-pellucid, project upwards and somewhat backwards; posterior tubercle stout, conical, prominent wrinkle or tubercle beneath; lateral borders rugose; hairs somewhat sparse, appressed, whitish, few pale yellow, dark based, short bristles project from fuscous spots; integument pale brownish stone-colour; folium tapers from fore-tubercles to posterior tubercle, defined by a light fuscous, sinuating line; median streak similar shade; three pair of blue-black impressed spots, two anterior pairs largest, form a trapezoid narrowest in front; light fuscous, nearly vertical, bands on lateral margins. *Corpus vulvæ* fulvus, somewhat triangular, convex elevation, wrinkles transverse, well-defined; broad and concave in front, margins tumid; projecting from within the dark concavity is a yellowish, rather wide septum, as broad at truncated apex as long.

Several examples. A. M.

Epeira singulara, sp. nov. Plate. Fig. 2.

Femina.—Ceph. th., long, 4; broad, 3·4; facial index, 2. Abd., long, 6·7; broad, 6. Legs, 1, 2, 4, 3 = 13, 12, 11, 8 mm.

Cephalothorax bright brownish-lake, clouded about caput and lateral margins with blackish-lake; hairs somewhat sparse, silky white and dark, former predominate on thoracic part; pars cephalica flatly-convex, dips abruptly into depression on posterior incline of thorax; truncation perceptibly rounded, ocular elevation fairly developed, lateral index equals space

from a hind-lateral eye to central of same row furthest from it; depth of *clypeus* scarcely equal to diameter of a fore-centre eye; pars thoracica broad-oval, convex, hind-slope occupied by an orange-brown, semi-oval, flatly-convex depression, fovea at apex, triangular, slight; normal grooves not well-defined; profile-contour rises from thoracic junction at a moderate angle, caput curve slopes at an angle of 35deg. to hind-row of eyes.

Posterior and anterior row of *eyes* moderately recurved; hind-median pair separated from each other by an interval equal to their diameter and one-half, and from laterals by their space and three-fourths; fore-centre eyes plainly more than their breadth from one another, rather less than an eye's diameter from posterior centrals, which they equal in size; distance separating them from side eyes visibly surpasses their space; laterals about one-half size of centrals, posited obliquely on moderate tubercular elevations, nearly contiguous.

Legs, femora, especially of I. and II., bright brownish-lake, other joints fulvus, green tinge; annuli fuscous, indications on thighs of III. and IV.; two wide annulations on patellery joints; three on tibial and metatarsal; fore-end of tarsi fuscous; moderately haired; spines brownish, somewhat sparse; tibial spines scarcely equal, transverse diameter of article; patellæ and tibiæ compressed, show two longitudinal grooves; former articles two-thirds length of latter, of equal length on third pair; superior tarsal claws—1st pair, stout, well curved, 8 teeth, 5 strong combs, 3 basal close small; inferior claw long, sharply bent, 2 small points.

Palpi fulvus, green tinge, annuli of pars humeralis and two fore-thirds of digital joint chestnut-brown; hairs whitish; spine armature moderate; palpal claw less curved than tarsal; nine teeth increasing in length and strength.

Falces reddish-chestnut, strongly gibbous at base in front, conical, vertical, half as broad as long; length equal to space occupied by front row of eyes; outer row of teeth, 4; inner, 3.

Maxillæ, length and breadth at extremity about equal, roundly pointed, inclined over *labium*, which is perceptibly wider than long, roundly and somewhat sharply pointed; organs, dark fuscous, margins, greenish-yellow.

Sternum, lake-black; hairs, white; cordate, centre prominent, eminences opposite coxæ moderate.

Abdomen angular-oviform, projects over base of cephalothorax, depressedly convex above; contour of profile represents a somewhat even curve across dorsum, dips abruptly to spinners from first row of tubercles, depth of dip equal to about one-half length of abdomen; humeral tubercles

obtuse-conical, project upwards and outwards; posterior tubercles, 5; first row slightly developed; tubercle of second row most prominent; clothed with short copper-coloured and white hairs; integument has a soft velvety appearance, brownish-fawn colour, speckled with light-brown, largest and scarcest spots deepest hue; folium tapers from humeral tubercles to spinners; margins sinuate, fuscous; flesh colour of tubercles encroaches into the normal fawn-colour; in line with eminences is a centrally-broken fuscous, oblong, transverse mark, connected by a short band with a greenish, ill-defined bar, surpassing the former in length; these marks occur between first and second pair of impressed spots; base of folium angular, defined by dark shading; at constriction of folium on posterior side of second pair of spots is a broken cross-bar; second occurs below third pair of impressed spots; posterior two-thirds of compressed portion of folium obliterated by a remarkable, large, sinuated, brass-coloured patch, metallic reflections, which curves round, suffusing almost all the right side of abdomen; ventral surface dull brown, lake tinge, fuscous clouding; shield fuscous. *Corpus vulvæ*, deep orange, costæ passing into red chestnut, scapus similar tints; stylus lemon-yellow; corpus trapezoidal nearly as wide at base as long, longitudinally depressed, laterally bounded by deep, projecting costæ, increasing somewhat in width towards, and revolute above the rima genitalis; scapus vulva curves over base of corpus, three-fourths its length, elongate-oval, transversely wrinkled, lateral border wide, tapers at fore-end, incurvate; apex of scapus projects rather beyond base of stylus; latter strongly segmented, base stout, second half tapers rapidly, about three-fourths length of scapus.

Only a single example of this handsome species was contained in Mr. Morton's collection; probably the remarkable irregular metallic markings on the abdomen are unique.

Var. a.—Colouration of *cepthalothorax* and *legs* resemble type-form. *Abdomen* grayish-fawn colour, markings deeper tone; pattern does not differ essentially from type-form.

Two specimens. A.M.

Epeira viridula, sp. nov.

Femina.—Ceph. th., long., 2·5; broad, 1·8; facial index, 1. Abd., long., 4; broad 3·5. Legs, 1, 2, 4, 3. = 7·5, 6·5, 6, 4 mm.

Cephalothorax light brown, fuscous clouding; fairly clothed with whitish hairs; clathrate; pars cephalica moderately convex, roundly truncated, ocular elevation prominent; *clypeus* in height visibly less than diameter of a fore centre eye; pars thoracica broad-ovate, convex; posterior incline depressed; fovea sub-oval, shallow, radial striæ well defined,

caput grooves moderately; profile line rises from thoracic junction at a tolerable angle to limit of caput, latter horizontal, perceptibly arched, eye eminence projects forwards.

Anterior and posterior row of eyes moderately and somewhat equally recurved; hind median eyes largest of eight, posited obliquely on the more prominent part of eminence, divided from each other by an interval equaling an eye's diameter and two-thirds, and from laterals of same row by scarcely their space and a quarter; fore-centrals less than one-third smaller than hind-pair, visibly more than their diameter from them, removed from each other by a space equal to an eye's breadth and one-quarter, separated from side eyes by rather more than their space; laterals about half size of fore centrals, seated obliquely on a common, strongish tubercle, their radius apart.

Legs fulvus, faint green tinge, fuscous patches on femoral joints, resolved somewhat into distal rings, on III. and IV.; patellæ clouded, tibiæ and metatarsi two annuli; hairs white, somewhat sparse; spines light, scarce; legs strong, patellary and tibial joints compressed, two well-defined grooves; superior tarsal claws—1st pair, 9 comb teeth; inferior claw 2 points.

Palpi colour and armature of legs; palpal claw 10 teeth.

Falces light-fulvus, clouded, conical, vertical, basal half prominent in front; length rather shorter than radial and digital joints of palpus, about as stout as the femur of first leg.

Maxillæ, length somewhat surpasses breadth, enlarged forwards, roundly pointed, inclined over *labium*, latter nearly as long as wide, well pointed, margin tumid; organs chocolate brown, fore-end pale olive brown.

Sturnum blue-black; cordate, eminences opposite coxal joints well-developed.

Abdomen oviform, depressed, humeral tubercles obtuse-conical, directed somewhat outwards and backwards; posterior tubercles well-developed, centre tubercle of first row much the largest and stoutest; tubercle of second line as strong as central of first; third short and fattened; pale brownish-fawn colour, suffused in more or less transverse patches, with dull rifle-green, few spots of same hue; margin of folium acutely sinuate, commences at base of humeral prominences, curves over, tapers to posterior row, obliterated on dip of abdomen; inner border olive-brown, outer creamy-brown; short angular mark of same colour on basal end; ill-defined, somewhat lanceolate, greenish figure in centre of dorsum; lighter shade predominates on ventral surface; shield olive-green, oval. *Vulva* pale yellowish-brown; represents a low, transverse,

oval elevation, prolonged into a broad, tapering, flatly convex, close lying scapus, fore-end slightly segmented.

Single example. A. M.

ÆREA, gen. nov.

Cephalothorax rather longer than broad, sub-parallel, lateral constriction slight; cephalic part large, elevated, rather abruptly inclined on all sides from posterior central eyes; anterior angles prolonged into strong, abscinded, sub-conical prominences, depressed above, directed outwards and forwards beyond the frontal line; *clypeus* retreating, centrally prolonged, pointed, depth equal to the space occupied by the fore-centre eyes; thoracic part depressedly convex; at junction with caput on same plane as anterior median eyes, indentation, radial and caput striæ shallow and irregular; contour of profile represents a rather even line rising from thoracic junction, at an angle of 30deg., to posterior central eyes, incline across ocular area somewhat more abrupt.

Eyes tolerably small, in three rows—4, 2, 2; or two procurved rows, posterior line being very strongly curved; fore-centrals form a trapezoid narrowest in front, rather longer than broad behind; laterals posited on truncated apex of lateral projections.

Legs of moderate and somewhat equal length, 1—2, 4, 3; first and second pairs stoutest, of about equal strength; patellary, tibial and metatarsal joints of two first pairs sub-aplanate; patella rather shorter than tibia, metatarsus and tarsus of about the same length; together nearly equal the two former articles in length; tibial and metatarsal joints armed their entire length, on both edges, with long, curved spines, intermediate spaces occupied by 3 or 4 smaller spines of similar form; tarsi furnished with an inner and outer row of close spines, not differing from metatarsal, except that they are shorter and of somewhat even size; tibiæ and metatarsi of third and fourth pairs have a few straight spines; superior tarsal claws of first pair, short, well-curved, 8 comb-teeth; inferior claw sharply bent; axillary claws.

Palpi moderately strong, armed with spines; palpal claw long, slender, 7 teeth, free end short.

Falces of tolerable strength and length, inwardly inclined.

Maxillæ short, length perceptibly surpasses the breadth, fore-end enlarged, roundly pointed, directed towards the *labium*, which is semi-circular, everted, breadth exceeding the length. *Sternum* sub-oval.

Abdomen sub-rhomboid, base truncated, posterior extremity enlarged, somewhat depressed above

Ærea alticephala, sp. nov. Plate Fig. 3.

Femina.—Ceph. th., long, 3; broad, 2·5; facial index, 2·4. Abd., long, 5·5; broad, 5·5. Legs, 1—2, 4, 3 = 7·5, 6·5, 4. mm.

Cephalothorax lake-black about ocular area, fore-sides of thorax, and lateral margins; dark shade passes between hind-median eyes tapering to limit of caput, enlarged at fovea; posterior incline of cephalic and thoracic parts fulvus, passing into a brownish lake; hairs whitish, appressed, somewhat in lines; luconose; sub-parallel, rounded posteriorly, lateral constriction slight; pars cephalica elevated, slopes on all sides rather abruptly from hind central eyes; grooved depression between latter; fore-angles developed into very stout, sub-conical projections, flatly convex above, directed outwards and forwards beyond frontal line; *clypeus* retreating, pointed, height equal to space of anterior median eyes; pars thoracica depressedly convex, on same plane as fore-centre eyes at its junction with caput; fovea shallow, ill-defined; caput and radial striæ slight, irregular; profile-contour rises from thoracic junction with a somewhat even line to posterior median eyes, at an angle of 30deg, slopes rather more abruptly to anterior centre eyes.

Eyes rather small; anterior row procurved; line through centrals intersects lateral pairs; median eyes posited somewhat obliquely on small, crimson-lake, discoid tubercles, separated from each other by an interval perceptibly exceeding an eye's breadth, and from laterals of same row by nearly twice their space; posterior row straight; forms a very strongly procurved line, with eyes of second row; eyes one-fourth larger than anterior pair, seated obliquely on well-developed, crimson-lake, discoid elevations, about one-fourth further from fore-centrals than they are from each other, an interval surpassing space of anterior pair by scarcely one-third; interval between tubercles fully equal to one-half the distance dividing them from fore-pair of tubercular eminences, separated from hind-laterals by their space and a half; side-eyes placed obliquely on abscinded apices of lateral projections, anterior eye more than twice size of posterior, latter about equal to a fore-central, divided from eye next to it by rather more than one-fourth its own diameter.

First and second pairs of *legs* lake-brown, suffused with chocolate-black, somewhat obscure annuli on tibiæ; hind pairs fulvus; coxal joints, two distal thirds—more or less—of femora and patellæ suffused with dark chocolate-brown; wide basal annulations on tibial, metatarsal and tarsal joints of same shade; legs, 1st pair rather stout, thighs compressed; patella and tibia sub-aplanate, former article grooved, less than one-fourth shorter than tibial joint, latter sub-linear; metatarsus and tarsus of nearly equal

length, together scarcely surpassed by the patellary and tibial joints; penultimate article aplanate, base incrassated; hairs whitish and yellowish, most numerous on tibiæ of I. and II.; tibial and metatarsal joints of I. and II. armed their entire length on both edges with long, flattish, brown, curved spines, directed forwards and outwards; metatarsal longest; tibiæ have about 6 on each side; metatarsi 7 on inner, 4 on outer edge; space between long spines occupied by from 3 to 4 much shorter spines of similar form and colour; lateral sides of tarsi armed the whole length with close spines similar but shorter than metatarsal; tibiæ of III. have about 3 spines beneath, 1 above; metatarsi 3 or 4 on inferior side; tibiæ of IV.; IV. pair 1 on superior, 3 or 4 on inferior side; metatarsi 4 or 5; superior tarsal claws—1st pair, short, well curved, 8 comb teeth; inferior claw sharply bent, points?; axillary claws.

Palpi, humeral and cubital joints fulvus, former article clouded, radial and digital lake-brown, clouded with black brown, both articles fairly furnished with hairs; cubital joint 1 spine; radial 2; digital 7; humeral rather shorter than two following articles together, two latter scarcely equal digital joint in length; palpal claw long, slender, first half straight, second moderately curved; 7 teeth, free end short.

Falces glossy, deep chocolate brown, apices lake tinge; bristle-like hairs at extremity, conical, inclined inwards, scarcely as long as radial and digital joints of palpus, rather stouter than the pars femoralis of a first leg; double row of 5 short teeth.

Maxillæ light reddish brown, pale greenish yellow apices; short, breadth nearly equals length, dilated forwards, roundly pointed, directed towards each other.

Labium chocolate brown, apex pale greenish hue; semi-circular, perceptibly wider than long, everted.

Sternum, dark fuscous; few coarse hairs, sub-oval.

Abdomen sub-rhomboid, base truncated, posterior fourth tumid, convoluted, dotted with small pits, sides dilated; dorsum rises, almost in line with humeral angles, into an obtuse-conical elevation; lateral margins longitudinally wrinkled; abdomen prolonged nearly one-third its length beyond spinners, which are short; darker parts, more especially, marked with rather large, circular or oval lacunose depressions, surrounded by numerous, very fine, sinuating wrinkles; hairs white, short, sparse; ground colour marbled with purple-black and brown; large, deep, creamy-coloured, cruciate figure occupies dorsal area, fore-part nearly as wide as long, displays five light brown impressed spots, three form a procurved line near basal margin, two occur at foot of conical elevation,

latter pair and centre spot of anterior line connected by a slight bluish cross; base of cruciate figure short, compressed, terminates at the creamy-coloured posterior third, this part throws off into the dark integument marks of irregular shape, connected with the somewhat sinuating, transverse bar, which curves round humeral angles passing into the creamy coloured ventral surface; vulva and spinners enclosed within an olive-black patch; triangle of three spots in centre, apex directed backwards. *Corpus vulvæ*, dull lake-brown; sub-reniform, moderately depressed area, bounded by an involute costa, inferior margin low and somewhat rugose, much enlarged at curvature, curved extremities divided by a pointed septum, whose breadth scarcely equals the greater width of costa; above the rima-genitalis are two short, black, clavate processes, directed towards apex of septum.

Single specimen. A.M.

Collina, gen nov.

Cephalothorax rather longer than broad, sharply constricted on lateral margins; cephalic part roundly truncated, ocular elevation low; fore-half depressedly convex, sides somewhat abrupt, depth exceeds breadth of dorsal surface; fovea and normal grooves well-defined; contour of profile strongly arched, highest part at the occiput; fore-third of caput inclined at an angle of about 45deg.

Eyes of moderate size, sub-equal, posterior and anterior rows slightly recurved, fore-centre eyes form a trapezoid widest in front; laterals separated from each other by an interval scarcely equal to their own radius.

Legs rather slender, moderately long—1, 2, 4, 3; first and second, third and fourth of about equal strength; patellary and tibial joints cylindrical; armature sparse, hairs fine, outstanding; spines slender, bristle-like; superior tarsal claws moderately curved; axillary claws.

Palpi, cubital, radial and digital joints, furnished with long, slender spines; numerous on the penultimate and terminal joints.

Falces conical, inclined forwards, stout.

Maxillæ enlarged towards extremity, roundly pointed, inclined towards *labium* which is rather wider than long, roundly pointed.

Sturnum cordate, eminences opposite coxæ well-developed.

Abdomen oviform, large.

Collina glabicira sp. nov. Plate fig. 4.

Femina.—Ceph. th., long, 4; broad, 3. Abd., long, 7; broad, 5·8. Legs, 1, 2, 4, 3 = 15·5; 12·5; 11·5, 9 mm.

Cephalothoraæ, chrome-yellow, suffused with a light-brown on cephalic part; freckled with brown; lateral border deeper tone; hairs pale, very sparse; length equals patella and tibia of 4th leg; pars cephalica large, first half depressedly convex, sides somewhat abrupt, roundly truncated, eye eminence low; lateral index equals two-thirds of facial; *Clypeus* retreating, surpasses in depth diamater of a fore-median eye; pars thoracica oval, convex, fovea sub-oval, caput and radial striæ tolerably strong; profile-contour strongly arched, prominent at occiput, dips across fore-third at an angle of 45deg.

Eyes of tolerable and about equal size, on blackish-lake rings; posterior row slightly recurved; centre-eyes divided by three-fourths their diameter, rather more than their space from laterals; anterior row more distinctly recurved, median pair less than their diameter and a half from each other, perceptibly more than an eye's breadth from hind-centrals, removed scarcely three-fourths their space from side eyes; laterals placed obliquely on separate lake-brown tubercular eminences, somewhat less than their radius apart, tubercles small, anterior strongest.

Legs somewhat duller hue than cephalothorax, tibial and metatarsal joints greenish shade; hairs fine, black; spines slender, black; 2 or 3 on femora; patellæ 1; about 6 on tibiæ of I. and II., less on same article of two hind-pairs; metatarsal joints apparently devoid of spines, except metatarsi of III., which have 1 spine; legs somewhat slight, patellery and tibial joints cylindrical.

Palpi and legs concolorous; bristle-like spines rather numerous on pars radialis and digitalis; humeral joint equal in length to cubital and radial together; two latter articles as long as digital joint.

Falces chrome-yellow; hairs black, sparse; conical, base gibbous, inclined forwards; small, plano-convex, conical lobes on outer side.

Maxillæ pale fulvus, base lightly suffused with olive brown, nearly as wide as long, dilated forwards, roundly pointed, directed towards each other.

Labium yellowish, fuscous shading; rather wider than long, roundly pointed, one-half length of maxillæ.

Sturnum fulvus, marbled with brown; heart-shaped, eminences opposite coxal joints.

Abdomen broad oviform, projects over base of cephalothorax, convex above; ground colour dull lake-brown, suffused with flecks; dorsum flecks dark creamy-colour, lobate, more or less confluent; medial streak, normal colour, terminates at posterior incline, displays four—probably in some examples

five—arcuate lines of similar colour; flecks on lateral margins inconspicuous, approximate to ground colour; ventral shield olive brown; branchial opercula chrome-yellow. *Vulva* orange brown; transverse, oval area, occupied by two deep, circular foveæ, intersected by a dark bordered, broad septum, their equal in breadth, laterally prolonged above the rima genitalis, extremities acute, revolute.

Single example. A.M.

Fam. CELAENIDEN.

Gen. Celaenia, Thor.

Celaenia voraginosa, sp. nov. Plate Fig. 5.

Femina.—Ceph. th., long, 5·2, broad, 6. Abd., long., 10; broad, 14; deep, 11. Legs, 1—2, 4, 3 = 21·2, 12, 10 mm.

Cephalothorax deep fulvus, olive tinge, passing into coffee-brown on lateral margins, furnished with numerous papillæ—mostly in rows, projecting, short, stout, black bristles; somewhat reniform, narrowly constricted at caput, pars cephalica, rather depressed, sides abrupt, mamiform eminences well-developed; prolonged somewhat upwards into a stout sub-conical projection, nearly as long as wide at base, occupying greater part of frontal space; *clypeus* retreating, depth perceptibly exceeds interval between a fore-centre eye and the lateral next to it; pars thoracica—viewed laterally, obtuse-conoid; series of six indentations occur at edge of posterior inclination, centre pair divided by the bisected fovea; radial striæ somewhat deep and short; caput grooves faint forwards, form strong, angular depressions at limit; profile-line rises at an angle of 30deg. from thoracic junction, dips forwards at a rather stronger inclination to mamiform elevation—which represents an obtuse-conoid projection, bends slightly upwards to posterior row of eyes.

Eyes tolerably small; posterior row recurved, line through centrals strikes fore-edge of anterior laterals, front row more strongly recurved; fore-central eyes posited on prominence, form a nearly quadrilateral figure, enclosing conical apex, front line rather shorter than hind, visibly surpasses sides; posterior pair one-third smaller than fore-centrals, placed on slight discoid elevations; anterior pair little more distant from side eyes than are the hind-centrals, a space about equal to the interval between one another; laterals scarcely equal to hind centrals in size, seated obliquely on a strong prominence nearly contiguous.

Legs creamy-yellow, second half—rather less—of femoral joints coffee-brown, stains on first half; patellæ and annulations normal brown; tibiæ have three wide rings; metatarsi three less defined annuli; tarsi suffused; annulations on tibial and metatarsal joints of two posterior pairs somewhat obliterated; I. and II., III. and IV. of about equal strength;

femora of two first pairs much the stoutest; tibial joints cylindrical, slender, about one-third longer than patellæ; metatarsi nearly twice length of tarsi, together one-third shorter than tibæ; hair short, somewhat sparse; femoral joints of I., II. and III. armed on inferior side with two irregular rows of sub-conical tubercles of various sizes, projecting short spines, tarsal claws of normal form; outer claw much the longest and strongest; inner sharply curved, three close teeth at base; inferior claw closely inflected, perceptibly stronger than inner; two pairs of axillary claws.

Palpi, pars humeralis creamy-yellow, brown rings, following joints fulvus, suffused with brown; armature short, black hairs; moderately long, stout; radial joint rather the longest and strongest, enlarged forwards; cubital joint much the shortest; pars humeralis and digitalis of about even length; palpal claw stout, sharply bent, 3 close teeth.

Maxillæ light coffee-brown; apices pale, greenish; moderately enlarged forwards, pointed, directed towards each other.

Labium base brown, fore-half pale; oval, rather wider than long.

Sturnum chocolate-brown, well-defined, large, yellowish lanceolate figure in centre, point directed towards lip, haft tapers to posterior end; cordate, tapers from the somewhat prominent eminences opposite coxal joints of third pair.

Abdomen large, nearly one-third wider between humeral tubercles than long; base rather broader than cephalothorax, concave, angles prominent, rounded; viewed laterally conoid, apex abscinded; summit occupied by large convoluted, somewhat semi-globose humps, sloping abruptly to the short, conical humeral tubercles, divided by a level space about one-half their own diameter; each hump indented by seven deep pits, three of which occur on each margin of intervening space; hind lobes of humps project over the abrupt posterior end, which is semi-oval; the outer pair display at their extremity brownish, nipple-like tubercles; posterior face of abdomen shows several well-marked foveæ, two largest form a trapezoid, widest below, with the hind-pair of the above-mentioned six pits; semi-circle of five impressed spots on posterior side of humeral tubercles; between hind-pair of foveæ and spinners is a large, somewhat oval space enclosed by small pits, area occupied by two centrally interrupted, transverse indentations; anterior slope slightly pitted; fore-part of abdomen creamy-colour, graduating into patches of pale brownish tints; on margin of basal concavity is a black, heart-shaped figure, on either side of it two streaks curve off towards fore-tubercles, upper streak brown, lower bluish; summit and posterior side light greyish fawn colour; humps and fore-sides appear to be tattooed with bluish lines, pattern

on fore-slope without any determinate limits, fades away into ground colour; anterior border of humps and posterior border of fore-patches blackish, somewhat sinuating, curve round the creamy-brown humeral tubercles; resolved behind into conspicuous, indigo-coloured, lunulate marks curving upwards round apex of the semi-oval area; latter and impressed spots on posterior region reddish. *Vulva* represents a narrow, transverse, brownish depression, projecting—over the rima genitalis, a moderately deep, cup-shaped, yellowish process.

Single example. A.M.

Celaenia tumidosa, sp. nov.

Femina.—Ceph. th., long, 6; wide, 6·8. Abd. long, 10·2; wide, 15; deep, 10. Legs, 1—2, 4, 3 = 23, 14, 12, mm.

Cephalothorax light mahogany-brown, passing into pale yellow-brown on margins, olive tinge; somewhat suffused and speckled with olive-brown; numerous papillæ projecting short, black hairs, chiefly in rows; cephalic part somewhat aplanate, sides abrupt; produced forwards and moderately upwards into a strong sub-conical projection; mamiform eminences well-developed; *clypeus* retreating, height visibly surpasses interval between a fore-median eye and the lateral next to it; thoracic region—viewed laterally, conoid, margin of hind-slope displays six rather deep indentations, bisected fovea intersects central pair; radial striæ well-defined, short; caput grooves represent deep angular indentations at junction with thorax, shallow forwards; contour of profile rises from thoracic junction at an angle of 30deg., inclined at about the same angle to base of the obtuse-conical mamiform prominences, bends slightly upwards to hind row of eyes.

Eyes rather small; fore-centrals about one-third larger and fore-laterals one-third smaller than hind-median pair; posterior lateral eyes visibly smaller than anterior pair; posterior row recurved, line through centrals intersects side-eyes; anterior row recurved, curvature stronger than posterior; fore-centrals seated on prominence, enclose conical apex; hind-pair rather more distant from each other than are the fore-pair, interval between latter pair visibly surpasses the space separating them from posterior centrals, which are posited on small discoid tubercles; fore and hind-centre eyes divided from laterals by an interval perceptibly exceeding space between fore-centrals; side eyes seated obliquely on tolerably strong elevations; three-fourths diameter of a posterior eye apart.

Legs green-tinged straw-colour, markings coffee-brown; second half of femoral joints dark; first half of anterior pair splashed; patellæ uniform brown, more or less broken and

confluent annuli on tibiæ; fore-end of metatarsi and tarsi suffused; I. and II., III. and IV. of about equal strength; thighs of first and second pairs much the strongest; tibiæ cylindrical, slender, one-third longer than patellary joints; metatarsi twice as long as tarsi, together shorter than tibial joints by one-third; hairs, fine, short; femoral joints of first, second, and third pairs armed beneath with two irregular rows of sub-conical tubercles, of different sizes; projecting short black spines; outer superior tarsal claw much the stoutest and longest; inner claw sharply curved; three close teeth; inferior claw closely inflected, somewhat exceeds inner both in length and strength; axillary claws.

Palpi greenish-brown; armature, fine, black hairs; stout, moderately long; radial joint incrassated forwards, surpasses other articles in length and strength; pars cubitalis, short; penultimate and digital joints of about same length; palpal claw short, sharply bent; three close teeth.

Falces greenish-brown, suffused with a deeper shade; somewhat hairy; taper moderately, directed inwards, fully as long as pars radialis of palpus; about as stout as basal end; fang, short.

Maxillæ, light greenish-brown, short; second half dilated, roundly pointed, directed towards each other.

Labium and maxillæ concolorous, perceptibly broader than long, semi-circular.

Sturnum fulvus, border fuscous, haired, oval.

Breadth of *abdomen* between the short, outward projecting humeral tubercles exceeds the length by scarcely one third; profile contour sub-conoid, anterior slope moderate, posterior dip abrupt; base procurved between anterior rounded protuberances; crest occupied by two large semi-globose, convoluted humps, prominent behind, separated by a level area about one half their diameter; impressed spots which occur on humps and on the fore and hind smooth regions do not differ essentially in their arrangement from the similar indentations found on *T. voraginosa*; ground colour of anterior slope creamy-fulvus, black heart-shaped spot above petiole throws off on either side, two olive-black sinuating lines converging towards each other on inner side of fore protuberances, latter display at their base, upper side, a dark impressed spot; humps closely tattooed with bluish-green lines and leaf-like marks; sides of anterior incline figured with similar but more open pattern; posterior side has a light copper-brown hue, suffused with an olive-brown shade, faint bluish streaks, indentations similar tint. *Vulva* (somewhat shrunken) represents a transverse, brownish, oval indentation,

margin above the rima genitalis produced into a rather large everted lip, brownish yellow above, whitish beneath.

Single example. A. M.

EXPLANATION OF PLATE.

Fig. 1. *Epeira Mortoni*, sp. nov. Vulva.

Fig, 2. *Epeira singulara*, sp. nov. Vulva.

Fig. 3. *Ærea alticephala*, sp. nov. Female, three times natural size ; a, caput ; b, part of a fore-leg ; c, vulva.

Fig. 4. *Collina globicira*, sp. nov. Female, three times natural size ; a, vulva.

Fig 5. *Celaenia Voraginosa*, sp. nov. Caput.

NOTES ON ACTINOMYCOSIS, AND ITS TRANSMISSIBILITY TO THE HUMAN SUBJECT.

By C. E. Barnard, M.D.

While I cannot but feel that some apology is due to the Royal Society for introducing a subject that might perhaps be regarded as purely medical, this feeling is removed by the consideration of its important bearing upon the public health, and may be held to justify me in bringing it before the Society. I refer to the question of the transmissibility of some bovine diseases to human beings by the consumption of the meat of diseased animals.

The primary object of my paper is to show that there is prevalent amongst the cattle in Tasmania, as well as in the adjacent colonies, from which we obtain a large proportion of our meat supply, a disease which resembles tuberculosis in some respects, but differs from it in the specific micro-organism that is the cause of the disease, and yet, like tuberculosis, is transmissible to the human subject, and is almost as distressing in its consequences.

Six years ago Dr. Perkins read an interesting paper before this Society on "Cancer in Cattle," and ably pointed out the probable danger of the use as food of animals affected with cancerous or osteo-sarcomatous swellings; and he urged that precautions should be taken to avoid the probable transmission of cancer to man by eating the flesh of animals so diseased.

As the tumours in the cases described resembled in external appearance those swellings that are undoubtedly due to a scrofulous taint or tuberculosis, Dr. Perkins considered that they also might be classed as such; and judging by his paper, he apparently was unaware of the true nature of the disease in question. He well described the appearance of the swellings, and, by microscopical and other specimens, he showed how the bone was affected, and how the tumours grew and formed secondary deposits in the system; but there is no mention of the specific micro-organism which is now found to be the cause of the growth.

At the time of his writing the paper there was no accurate knowledge available that would give any clue to the true cause of the cancer. Dr. Perkins himself did not regard it as ordinary cancer, for he says that "though I have examined several specimens, I have not yet come upon cells which in any way resemble those of cancer," and he favours the idea that the tumours are due to tuberculosis.

Previous to Dr. Perkins's paper, Mr. Willows, N.S.W. Government Veterinarian, in conjunction with Mr. Park of Hobart, was empowered by the Hon. the then Premier of Tasmania to report upon the alleged cancer in cattle of this colony. In his report Mr. Willows considered the tumours to be due to a tuberculous taint; and he urged that prophylactic measures be rigidly enforced with a view to stamp out the disease, and he concludes by saying, "I am of opinion that the consumption of meat or milk from scrofulous or tuberculous animals is always dangerous."

In Europe this disease, so far as it was judged by external appearances, had been long recognised, and was described under various designations, such as osteo-sarcoma, cancer, etc., and usually it was attributed to a tuberculous condition of the system affecting the glands.

It is only of comparatively recent years, since 1876, that these tumours have been demonstrated to be due to the presence of a parasitic fungus, called actinomyces or ray-fungus, from its ray-like appearance, and hence the disease is called Actinomycosis.

Soon after the publication of the discovery of the actinomyces or ray-fungus in diseased cattle, the same vegetable parasite was found in man; and it was then seen that the tumours in the bovine species presented great similarity to those found in the human subject, leading to the presumption that it was identically the same disease.

Besides cattle the actinomyces have been found in animals which have suffered from cancerous disease, as the pig, and the dog.

About four years ago Mr. Archibald Park who has carefully studied this subject, called attention to the presence of certain peculiar bodies in these cases of cancer, which he thought differed from true tuberculosis. And as the published accounts in the veterinary literature of the day, of the discovery of actinomyces in a similar disease to this cancer in Europe, agreed with what he observed in the cases in Tasmania, Mr. Park came to the conclusion that the disease in this colony must be the Actinomycosis of Europe.

Previous to his departure to England nine months ago Mr. Park brought me a specimen of one of these osteo-sarcomatous tumours from the lower jaw of a cow. Having made sections we examined them under the microscope, when the distinguishing characteristic club-shaped bodies of the actinomyces or ray-fungus were unmistakably seen, agreeing in all respects with the published accounts of the parasite, thus establishing the fact of the disease in Tasmania being undoubted Actinomycosis.

Having taken with him to England this same specimen, Mr.

Park showed it to the best authorities in London, who confirmed the diagnosis, and were much interested in the discovery.

Sections of the specimens referred to are now on the table for inspection, when members will be enabled to examine by the microscope the peculiar ray-fungus that is associated with the disease in question.

The fungus tufts vary in size from a pin's point to a pin's head, and may be readily seen with the low power of the microscope; but it requires a high power to distinguish the characteristic club-shaped bodies which are arranged in the form of a rosette, or in a radiate manner. When thin sections are cut the larger tufts drop out, leaving round vacant places which give the specimen a reticulated appearance.

Appropriate staining brings out very prominently three different elements which are easily distinguishable under the higher power; first minute granules, or micro-cocci; second, fine threads of mycelium; third, disposed in a radiate manner round the edge of the tufts, larger ovate or club-shaped bodies.

These three elements are not always to be found in the same specimen, and frequently the clubs are not seen, or possibly are not brought out in the staining; but when found they are deemed to be the characteristic element of the darasite. The discovery of this parasitic fungus has been the starting point for many valuable investigations; and it is surprising to find how many obscure diseases there are whose origin may be traced to the presence of this vegetable parasite, and many diseased organs thought to be suffering from tuberculosis have been found to contain the actinomyces, and not the tubercle bacillus.

Our chief interest in the fungus is centred in the fact that identically the same parasite as is found in the lower animals is discovered to be the cause of similar diseases in the human subject. Several well-authenticated cases have been published of undoubted Actinomycosis in human beings having a fatal termination. How these patients became inoculated with this disease it is difficult to say.

It has been shown by experiment that the introduction of the fungus by inoculation into a calf has produced swellings which contained the characteristic clubs of the fungus, thus suggesting that this disease can be transmitted by direct inoculation.

Many similar experiments have been made with a view to prove the transmissibility of this vegetable parasite from animal to animal, and in the majority of cases with a positive result.

There can be no doubt that, in whatever way the actinomyces are taken into the human system, whether by injection, inhalation, or inoculation, there is every liability of their growing and multiplying to the injury of the patient.

The fungus may find entrance by wounds and abrasions of the mucous membrane of the mouth and alimentary system, in a similar manner that other micro-organisms have been proved to enter.

Wherever they find a lodgment they proceed at once to develop, forming mycelial threads and spores; and just as in the case of similar parasites, they set free, in the vicinity of the parent fungus, spores, which give rise to fresh individuals. These spores are carried about by wandering cells, and in this way they give rise to fresh centres of growth. Although it may be well understood how the actinomyces increase and multiply inside the animal system, when once introduced, there is some difficulty in ascertaining the mode of infection from without.

As the most common seats of the disease in cattle are the tongue and jaws, this fact seems to point to lesions in this region as being the mode of entrance of the actinomyces; and where the lungs are alone affected probably the minute fungus has been inhaled. And as it has been observed that the fungus prevails on some pastures to an unusual extent, it is natural to suppose that the animals have acquired the disease through grazing on such sharp-pointed grasses as wound the mucous membrane of the mouth, such as the spear grass, and also briars, gorse, etc.

In whatever way the disease is propagated, there should be no hesitation in arriving at the conclusion that all possible endeavours should be made to prevent the spread of the disease to man, and to lessen the risk of infection by the most obvious methods, such as the destruction of infected animals, and the prohibition of the diseased meat from being used as food. Every animal suffering from the disease is a menace not only to its fellows in the same field, but also to the human beings brought into contact with it.

One may compare this disease to leprosy, which is caused by a microscopic bacillus, and which is highly infectious by contact; and as a practical consequence of this infectivity the leper is kept isolated from others.

Mr. Park, when recently in Queensland, made some inquiries as to the extent to which this cancerous disease prevailed there, and ascertained that cases of human Actinomycosis were frequently met with, more especially on those runs where the cattle were similarly affected. It is believed, upon medical authority, that many of the cases of cancer occurring

in Queensland are attributable to the ray-fungus, or in other words are Actinomycosis.

In Queensland, since December of last year, the owners of diseased cattle have been compelled, by regulation of the Public Health Act, to destroy all animals affected with these cancerous diseases; and all animals exposed for sale as food in the market, proved to be diseased, can be seized and destroyed.

On some of the cattle runs it is said that this disease prevails to the extent of about 10 per cent.; and as we obtain some of our meat food from this region, a rigid inspection of all animals arriving by sea is highly necessary.

At Kiama, in N. S. Wales, Mr. Stanley, the Government Veterinarian, at the instance of the Board of Health there, made enquiries into the causes of diseases, tuberculosis and cancer, affecting dairy cattle in that district. In the milking cows he found tuberculosis and Actinomycosis; and tuberculosis in the pigs that were being fed on the milk from those cows which supplied the local butter factory, and which likewise were fed on offal from the slaughteryards.

These facts have been confirmed by Mr. Park, in an examination of portions of the diseased structures taken from these animals given to him by Mr. Stanley. Microscopic slides of these specimens are on the table and can be examined by the microscope, when the actinomyces will be plainly visible.

The presence of actinomyces in these specimens, as well as of the tubercle bacilli, is confirmed by the diagnosis of three medical experts in Sydney, who were called upon to make a microscopic examination of the diseases in question, and who have published their opinions on the subject in the report of the Board of Health of N.S. Wales, dated 9th October, 1890.

The few facts that I have been enabled to bring before the Society this evening show that there is a large field for investigation which has scarcely as yet been entered upon. If the diseases I have been discussing were thoroughly investigated in this colony, and experiments made with a view of testing the extent of the prevalence not only of these, but of other diseases, valuable results would no doubt be shown. And I cannot too strongly urge that this investigation should be made, for, as in the case of tuberculosis and Actinomycosis, other diseases will be found to prevail more extensively than has hitherto been suspected.

A Central Hygienic Institute was recommended by the last Intercolonial Stock Conference, to which all cases of disease amongst animals should be referred from all the colonies. Without some such institution it is not easy to see how

information can be obtained as to the extent these diseases prevail in our midst.

A similar institution should be founded in connection with the Health Department of this colony, as modern science now is not content with mere superficial examination, but proceeds with more strict and reliable methods to detect the micro-organisms, which are undoubtedly the active agents in the production of disease.

I cannot conclude these notes better than by quoting the closing words of Professor Robert Koch in an address before the International Medical Congress held in Berlin, August, 1890, in which he had for the first time clearly foreshadowed the result so far of his researches for the purpose of discovering a method of arresting the development of tuberculosis in the animal system, and had expressed a hope that he was on the eve of complete success in obtaining this grand result. He concludes as follows:—"Allow me, therefore, to conclude this address with the expression of a wish that the nations may measure their strength on this field of labour and in war against the smallest, but the most deadly foes of the human race, and that in this struggle for the weal of all mankind one nation may always strive to surpass the other in the successes which it achieves."

WHAT SCIENCE AND COMMERCE MAY GAIN FROM AN ANTARCTIC EXPEDITION.

By A. Morton, F.L.S.

What is to be gained from an Antarctic Expedition is a question so frequently asked that some notice should be taken of it, and an answer framed that, if possible, shall be satisfactory.

Perhaps a reference to what has been done by Arctic Exploration may encourage belief that some benefit would accrue from a properly equipped expedition to the Antarctic region. Observations in the far north have been of incalculable value for the confirmation or correction of scientific theories relating to ocean currents, magnetic deviations, climatology, geographical distribution of plants and animals, and a host of similar subjects; while, as to commerce, it is only necessary to mention the discovery of the White Sea route to Russia, with its consequent trade, the establishment of the Spitzbergen fisheries, and the opening up of new and lucrative whaling grounds in Baffin's Bay and Prince Regent's Inlet, as convincing proofs of the usefulness of many expeditions that promised less in the way of discovery than one to the Antarctic regions. Magnetic researches of the higest value were made during the voyage of Captain Ross to the South Polar regions, and he was able to fix the position of the line of non-deflection of the compass.

Until we know all that can be discovered as to the limit of pack ice, the extent of the Antarctic Continent, the influence of Mount Erebus, the distribution of flora and fauna, and the probabilities of successful whale fishing, there will still be enough to gain, either from a commercial or scientific point of view, to make it worth while to send an expedition to the Antarctic regions. If the *Times* (England), has been correctly reported, it advocates, in preference to an Antarctic Expedition, a fresh attempt to discover traces of Leichhardt in Central Australia. One can scarcely conceive what comparison is possible between the two, though each might be said to be desirable from different points of view, but if they are to be compared, I should be inclined to think that by far the greater advantage, whether for scientific or commercial purposes, lies with the expedition we are considering.

Dr. Neumayer, who for many years has kept the subject of Antarctic Exploration before Germany and the world, com-

ments on the importance of scientific observations inside the Polar Circle, and maintains that for the purpose of discovering those general laws which are necessary as guides and standards in the interpretation of phenomena in climatology and physical geography generally, the South Polar regions are much better adapted than the North. The dictum of Captain Cook, that the ice he met in lat. 71deg. 10min. S. extended to the Pole, and his prediction that no man would venture further than he had done, was set aside successfully by Captain Ross, who penetrated 420 miles to the south of the point at which the great navigator turned back.

With the general results of his voyages, accomplished, be it remembered, without the aid of steam, you are all perfectly familiar. And here let me say that while heartily sympathising with the Geographical Society of Australasia in its efforts to assist the proposed expedition under Baron Nordenskiold, and appreciating the private liberality which has been displayed in the matter, I yet think the sum of £10,000 quite inadequate to produce any great results, or to fit out an expedition that would do much more than has already been done.

Let England and Australasia unite in sending an expedition, so equipped and manned, that failure, if not impossible, shall at least be unlikely, and we may confidently look for results that shall satisfy even the most incredulous as to the wisdom of Antarctic Exploration. Some remarks by Dr. Petermann on "Circumpolar Expeditions," read at a meeting of the Royal Geographical Society, of London, are worth quoting for their applicability to the case in hand:—"Although the Geographical and Scientific world," he says, "would be contented were an Expedition sent out for the sake of Science alone, nevertheless the whale fisheries in the Polar regions are also of great importance, as instanced by the one fact that the American whale fisheries in Behring Straits amounted in two years to the value of 8,000,000 dollars. . . . The English, having the best men, vessels, outfit, and resources, are best fitted to send out an expedition. When the French and American Expeditions, under Captain d'Urville and Lieutenant Wilkes, were sent out to the Antarctic Seas, together with Sir James Ross, it was clearly seen that only the English were quite at home in the Polar elements; they fearlessly went on with their important explorations for three consecutive years, whereas the other squadrons were always beaten back in their attempts to penetrate towards the South Pole. Captain Sherard Osborne, R.N., C.B., an eminent authority on the Polar regions, in a paper read before the Royal Geographical Society of England in 1865, speaks as follows:—"An

exploration of the Polar area should always be sent under naval auspices and naval discipline. I have no faith in purely private expeditions; on such a service as this I advocate we need all the resources of a naval dockyard, all the special knowledge collected in various departments—whether in the preparation of vessels, food, raiment, sledges, or equipment—to insure the work being well and safely done. The Navy of England cries not for mere war to gratify its desire for honourable employment or fame, there are other achievements it knows well, as glorious as victorious battle. Upon these points, as well as those of scientific results, it would not be too much to ask for a fraction of the vast sum yearly sunk in naval expenditure, for two small screw vessels and 120 officers and men, out of the 50,000 men annually placed at the disposal of the Admiralty."

This practical advice, coming from such an authority in 1865, is worthy of serious consideration at the present moment. In a letter written by Lady Franklin, dated Madrid, April 6, 1865, the following passage occurs:—"For the credit and honour of England, the exploration of the North Pole should not be left to any other country. It is the birthright and just inheritance of those who have gone through fifteen years of toil and risk in Arctic Seas. The glory that yet remains to be gathered should be theirs."

I should like to say in concluding, for the credit and honour of England and Australasia, the exploration of the South Pole should not be left to any other country, but should be taken up by England, who would, I am sure, be ably and willingly assisted by her loyal Australasian subjects.

DESCRIPTION OF A FERN *(BLECHNUM CARTILAGINEUM)*, NEW TO THE TASMANIAN LIST.

By R. M. Johnston, F.L.S.

By the kindness of Mr. Leonard Rodway I have had the opportunity given me for making a critical examination of a new fern discovered recently at George's Bay by Mr. G. K. Hinsby. Both of these gentlemen are well known as industrious collectors of plants, more especially as regards our little known *Fungi*, and we may hope to gain from them at some early day further valuable additions to our knowledge of the Cryptogamic plants of this island.

The new fern submitted to me by this gentleman might at first sight be readily mistaken for some of the abnormal forms of *Lomaria discolor*, where, at times, several of the pinnæ of the fertile fronds are less contracted or enrolled upon each other; but a closer examination showed that the lines of *sori* were arranged differently, being continuous, and situated close and parallel on each side of the costule, with a membranous indusium opening from under the costule outwards, and thus answering exactly to the generic characteristics of *Blechnum*. This genus is very closely allied to *Lomaria*, but in the latter (whose linear sori are placed nearer the margin, and opening on the inner side next to costule), the sori at length covers the whole of the under surface, and these are themselves often closely enwrapped by the marginal borders of pinnæ which sometimes assumes a cord-like appearance by the extreme flexure. The margin of the species of *Blechnum* about to be described are not so characterised, the sori only at length covering the costule and middle of pinnæ; the margins are not reflexed.

Still further examination showed that the species discovered by Mr. Hinsby was in all respects identical with *Blechnum Cartilagineum*, Swartz, a species hitherto only known from the mainland of Australia, where it is found in similar situations, *i.e.*, along creek-sides and borders of scrubs, in southern Queensland and New South Wales, and in several places in Gippsland, Victoria. The addition of a new *genus* as well as a new *species* to our list of Tasmanian Ferns, is of the very greatest interest, and now that we know of its existence locally, I am convinced it will soon be discovered in other localities, where possibly it has been overlooked or confounded with the everywhere abundant *Lomaria discolor*. I have a vague idea (now that I have examined the George's Bay specimen), that I have seen the same fern on the banks

of the North Esk, overhanging the river between Launceston and St. Leonard's. The Launceston botanists might easily verify this matter.

The following is a description of the new species thus referred to :—

Genus Blechnum. Linn.

Rhizome short and thick, or slightly elongated, and horizontal or erect; *fronds* pinnate, deeply pinnatifid, or in some species (not Australian) bi-pinnate or even simple; *pinnæ*, or segments, narrow; *sori* in a continuous line on each side of the costule, with a membranous indusium opening from under the costule outwards, the two sori often at length confluent, concealing the costule (mid-rib.)

B. Cartilagineum. Swartz.

Caudex oblique, densely clothed at the crown with blackish febrillose scales; *stipes*, strong, erect, 4-6in. l., scaly and muricated in the lower part; *frond*, ovate-oblong, 1-2ft. l., 6-9in., br'; *pinnæ*, numerous, erecto-patent, linear, 4-6in. l., $\frac{1}{4}$-$\frac{1}{2}$in. br., narrowed gradually towards the point, the margin finely toothed, dilated and connected at the base, the lower ones not conspicuously smaller than the others; *texture*, coriaceous; *rachis* and both surfaces naked; *veins*, fine; *sori*, in a broad line, *close* to the mid-rib. Hab.—Temperate. Australia (New South Wales, Queensland, Gippsland, Victoria: George's Bay, Tasmania.)

TABULAR LIST INDICATING THE LOCAL HABITATS AND THE GENERAL DISTRIBUTION OF ALL THE KNOWN FERNS, CLUB MOSSES, AND PILLWORTS OF TASMANIA.

By R. M. Johnston, F.L.S.

Since my "Field Memoranda for Tasmanian Botanists" was published sixteen years ago (1874), there has been a considerable alteration in the nomenclature of species as adopted in Hooker's Flora of Tasmania, as well as additions to the list of species then known. Now that our zealous Secretary is about to issue a new and comprehensive Descriptive Catalogue of all the Ferns of the island known at the present time, I have thought it desirable to place on record a revised list of the species, together with as complete a list of the localities of the various species as are known to me, with the desire to aid him in making this portion of his valuable work as complete as possible.

Tasmanian Ferns, Club Mosses and Pillworts.

FILICES.

Tribe i. Ophioglosseæ.

1. Ophioglossum vulgatum. *Linn.* Adder's-tongue.
2. Botrychum lunaria. *Swartz.* Moonwort.
3. ———— ternatum. *Swartz.* Grape Fern. (B. virginianum.)

Tribe ii. Schizaceæ.

4. Schizea fistulosa. *Labill.*
5. ——— bifida. *Swartz.*

Tribe iii. Osmundeæ.

6. Gleichenia circinata. *Swartz.* Parasol Fern.
7. ———— dicarpa. *R. Br.* (G. microphylla.)
8. ———— flabellata. *R. Br.*
9. Todea barbara. *T. Moore.* (T. Africana.)

Tribe iv. Hymenophylleæ.

10. Trichomanes venosum. *R. Br.* Bristle Fern.
11. Hymenophyllum marginatum. *Hook. et Grev.* Filmy Fern.

12. Hymenophyllum rarum. *R. Br.* Filmy Fern
13. ——————— javanicum. *Spreng.* Filmy Fern. (H. flabellatum.) (H. demissum.)
14. ——————— tunbridgense. *Swartz.* Filmy Fern.
15. ——————— *var.* Wilsoni. *Hook.* Filmy Fern.
16. ——————— Malingii. *Metten.* Filmy Fern.

Tribe v. CYATHEÆ.

17. Cyathea medullaris. *S. W.* Black Tree Fern.
18. Alsophila australis. *R. Br.* Prickly Tree Fern.
19. ——————— excelsa *var.* Cooperi. *R. Br.*

Tribe vi. POLYPODIEÆ.

20. Dicksonia antarctica. *Labill.* Woolly Tree Fern.
21. Davallia dubia. *R. Br.* Prickly Tree Fern. (Dicksonia.)
22. Lindsayea linearis. *S. W.*
23. ——————— trichomanoides. *Dryana.*
24. Adiantum æthiopicum. *Linn.* Maiden Hair.
25. ——————— formosum? *R. Br.* Maiden Hair
26. Hypolepis tenuifolia? *Bernb.*
27. Cheilanthes tenuifolia. *S. W.* Parsley Fern.
28. Pteris falcata. *R. Br.* Ear Fern. (Platyloma, Pellæa.)
29. ——————— tremula. *R. Br.*
30. ——————— aquilina. *Linn.* Bracken.
31. ——————— incisa. *Thumb.* Bat's-wing. (Litobrochia.)
32. ——————— comans. *Forst.* (P. Endlicheriana.) (Litobrochia.)
33. Lomaria Patersoni. *Spreng.*
34. ——————— vulcanica. *Blume.*
35. ——————— discolor. *Wild.*
36. ——————— lanceolata. *Spreng*
37. ——————— alpina. *Spreng.*
38. ——————— fluviatilis. *Spreng.*
39. ——————— capensis. *Wild.* (L. procera.)
40. Blechnum cartilagineum. *S. W.*
41. Doodia aspera. *R. Br.* Prickly Doodia.
42. ——————— *var.* caudata. *R. Br.*
43. Asplenium trichomanes. *Linn.* Maiden hair spleenwort.
44. ——————— flabellifolium. Fan-leaved spleenwort.
45. ——————— obtusatum. *Forst.*

46. Asplenium bulbiferum. *Forst.*
47. ——— -- flaccidum. *Forst.*
48. ——-——— umbrosum. *J. Sm.* (A. Brownii.) (Athyrium)
49. Cystopteris fragilis. *Bernb.* Little bladder Fern.
50. Aspidium aculeatum. *S. W.* Lady Fern. (Polystichum vestitum)
51. ——— capense. *Wild.* (Polysticum coriaceum.)
52. ——— decompositum. *Spreng.* (Nephrodium.)
53. ——— hispidum. *Sw.*
54. Polypodium australe. *Melten.* (Grammitis.)
55. ——— grammitidis. *R. Br.*
56. ——— punctatum. *Thumb.* P. rugosulum.)
57. ——— pustulatum. *Forst.* (P. Billardiera), (Phymatodes.)
58. Grammitis rutæfolia. *R. Br.* Blanket Fern. Gymnogrammæ.
59. ——— leptophylla. *S. W.* Jersey Fern. Gymnogrammæ.

LYCOPODEÆ.

1. Phylloglossum Drummondii. *Kuze.*
2. Lycopodium selago. *Linn.* Fir Club Moss.
3. ——— varium. *R. Br.*
4. ——— clavatum *var.* fastigiatum. *Linn.*
5. ——— Caroliniana. *Linn.*
6. ——— laterale.
7. ——— diffusum. *R. Br.*
8. ——— densum. *Lab.*
9. ——— scariosum. *Forst.*
10. Selaginella Preissiana. *Spreng.*
11. ——— uliginosa. *Spreng.*
12. Tmesipteris tannensis. *Bernb.*

MARSILEÆ.

1. Isoetes Gunnii. *Braun.*
2. ——— humilior. *Müell.*
3. ——— elatior. *Müell.*
4. ——— Stuartii. *Braun.*
5. Azolla feleculoides. *Lam.* (A. rubra.)
6. Pilularia globulifera. *Linn.*

ABBREVIATIONS.

T.—Tasmania.

W.A.—Western Australia.

S.A.—South Australia.

Q.—Queensland.

N.S.W.—New South Wales.

V.—Victoria.

N.Z.—New Zealand.

E.—Europe.

NOTE.—The last column in the accompanying Table of Distribution refers to the number of the Species under each Group in the preceding list. (R.M.J.)

TASMANIAN FERNS, CLUB MOSSES, AND PILLWORTS.

Distribution.

HABITAT.	TYPICAL LOCALITIES IN TASMANIA.	TAS.	W.A.	S.A.	Q.	N.S.W.	V.	N.Z.	E.	INDEX NO.
	FILIGES.									
Among grass in damp situations.	Glen Dhu, Launceston, Chudleigh, Formosa.	—		—	—	—	—	—		1
	Westbury, Chudleigh.	—								2
	Chudleigh, ascending to 4000 feet altitude.	—			—	—	—	—		3
On damp, shaded, grassy places.	George Town, Supply River, Ilfracombe, Southport.	—					—	—		4
In sand near the sea, among ti-tree scrub or heath.	George Town, Huon Road, Hobart, Blackman's Bay, Southport.	—		—	—	—	—	—		5
In boggy places among scrub.	North-West Bay, Huon and elsewhere, common.	—	—	—	—	—	—	—		6
In boggy peat.	George Town, tops of all mountains, Brown's River, Deloraine, Huon and elsewhere, common.	—			—	—	—	—		7
Among rocks in damp shaded forests.	Common in the ravines of mountains.	—			—	—	—	—?		8
Creek sides.	North-West Coast, Chudleigh, Deloraine, first basin, Launceston, York Town, George's Bay, Recherche, Longley, Port Davey.	—				—	—			9
In damp wooded ravines on tree ferns.	Ilfracombe, Gould's Country, Huon, Russell Falls, Mount Wellington.	—				—	—	—		10
On mossy rocks and trunks of honeysuckles.	Honeysuckle Hill, Queen River (T. B. Moore), rare.	—				—				11
On trunks of tree ferns.	In all damp ravines, on mountain slopes or uplands.	—				—	—	—		12
On damp mossy rocks.	Mount Wellington, Huon River, and elsewhere, among tree fern groves.	—			—	—	—	—		13
" " "	First basin, Launceston, Mount Wellington, Huon River, and all damp ravines in creek bottoms.	—			—	—	—	—	—	14-15
On damp mossy rocks and trunks of trees.	Honeysuckle Hill, Queen River (T. B. Moore), rare.	—				—	—	—	—	16
Damp woods.	Near Circular Head, rare.	—				—	—	—		17
"	George Town, Asbestos Hills, Nine Mile Springs, Ringarooma, Gould's Country, Macquarie Harbour, etc.	—			—	—	—	—		18
"	Adamson's Peak, rare.	—				—	—	—		19
In damp upland forests and mountain gullies.	Common throughout the island.	—			—	—	—	—		20
Sides of creeks.	Chudleigh, Don, near Westbury, Tamar, George's Bay.	—			—	—	—	—		21
Damp heathy places.	Bellerive, Huon River, Punch Bowl, Launceston, Brown's River, and elsewhere.	—	—	—	—	—	—	—		22
Dense forests.	Macquarie Harbour, Flinders Island.	—				—?		—		23
In shaded places among rocks.	Cataract Hill, Launceston; Knocklofty, Sugar Loaf Hill, Bellerive, Domain, Proctor's Road Creek, and elsewhere, common.	—	—	—	—	—	—	—		24
" " "	Doubtful. Referred to Tasmania by Mr. F. M. Bailey.	—?			—	—		—		25
Borders of Scrubs.	Doubtful. Supposed to exist near Chudleigh.	—?			—	—	—?	—		26
Among dry rocks in basaltic and greenstone ridges.	Cataract Hill, Domain, Mount Rumney, and elsewhere.	—	—	—	—	—	—	—		27
clefts of precipitous rocks and damp situations.	Cataract Gorge, Launceston; and elsewhere.	—			—	—	—	—		28
In forests.	Cataract, Launceston; Mount Wellington, Cascades.	—	—	—	—	—	—	—	—	29
Sandy places.	Common everywhere.	—			—	—	—	—		30
In damp woods and ravines.	Common everywhere.	—			—	—	—	—		31
" " "	Circular Head, Arthur's River, Chudleigh.	—			—	—	—	—		32
Creek sides in forest ravines.	George Town, George's Bay, Gould's Country, New Norfolk, Cascade River, Tasman's Peninsula.	—			—	—	—	—		33
Sandstone and mudstone cliffs, along deep ravines and waterfalls.	The Fronts, Westbury; Don, Russell Falls, Snug Falls, Mount Wellington, M. La Perouse, Longley.	—			—	—	—	—		34
Peaty Bogs.	Common everywhere.	—			—	—	—	—		35
Wet rocks, along ravines, and near waterfalls.	Russell Falls, Mount Wellington, Snug Falls, Henty River, and elsewhere, common.	—			—	—	—	—		36
In damp situations.	St. Patrick's River, Ben Lomond, Mount Wellington.	—			—	—	—	—		37
In deep mountain gullies, in sides of creeks.	Mount Wellington, Acheron River, Fronts, Westbury; Gould's Country, Huon River.	—	—	—	—	—	—	—		38-39
Sides of creeks and rivers.	George's Bay (G. Hinsby), rare in Tasmania.	—			—	—	—	—		40
Among greenstone rocks.	Cataract Gorge and elsewhere.	—			—	—	—	—		41
" " "	Cataract Gorge and elsewhere.	—			—	—	—	—		42
In caves and shady crevices of rocks.	Cataract Gorge, Chudleigh, River Plenty, Fronts, Westbury.	—			—	—	—	—	—	43
In shady crevices of rocks.	Common everywhere.	—	—	—	—	—	—	—		44
Among rocks, in clefts near the sea.	George Town, East Coast, Maria Island, Variety Bay.	—				—	—	—		45
In damp woods and ravines.	Common everywhere.	—		—		—	—	—		46-47
In shady crevices of rocks.	Cataract Gorge, Launceston; Circular Head, Chudleigh, Don, Gould's Country, Huon River.	—			—	—	—	—		48
Mountainous regions.	Chudleigh, Ben Lomond, and elsewhere.	—			—	—	—	—		49
In damp woods.	Common everywhere.	—			—	—	—	—		50
" "	Mount Wellington, Huon River, Gould's Country, common elsewhere.	—				—	—	—		51-52
In scrub.	Near Corinna, West Coast Track to Macquarie Harbour.	—				—	—	—		53
On mossy trunks of trees, especially fallen ones in damp mountain forests.	Mount Wellington, Huon, Gould's Country, and elsewhere, common.	—			—	—	—	—		54-55
In damp forests.	Mount Wellington and elsewhere, common.	—				—	—	—		56
Climbing on rocks and trees.	In moist, shady places, near creeks, common.	—				—	—	—		57
In shady crevices of basaltic or greenstone rocks.	Cataract, Launceston; Distillery Creek, Breadalbane, Brighton, Launceston, Rivulet, New Norfolk; Proctor's Road.	—	—	—	—	—	—	—		58
" " " "	Cataract Gorge, Launceston; Cave near Tamar, Spring Bay, rare.	—	—	—		—	—	—		59
	LYCOPODEÆ.									
Peaty ground.	George Town.	—								1
" "	Mountain tops and forests.	—					—	—		2
" "	Mountain tops and forests.	—					—	—		3
" "	Mountains.	—	—				—	—		4
" "	Mountains.	—					—	—		5
" "	Mountains.	—				—	—	—		6
" "	Mountains.	—					—	—		7
Heathy places.	Huon, Snug River, Southport, and elsewhere, common.	—				—	—	—		8
Peaty ground.	Mountains.	—					—	—		9
" "	South Esk River and elsewhere in the north.	—			—		—			10
Sandy peat.	Bellerive and elsewhere, among heath, common.	—				—	—			11
In mountain gullies on tree ferns.	Mount Wellington and elsewhere, common.	—			—	—	—			12
	MARSILEÆ.									
Bottom of shallow mountain lakes.	Ben Lomond, Great Lake, and elsewhere.	—								1
Rivers.	South Esk.	—								2
"	South Esk.	—								3
"	South Esk.	—								4
Moss-like plants, floating in water.	Brighton, Circular Head.	—								5
Rivers.	Penquite, near Launceston; Formosa.	—								6

THE DISCOVERY OF VAN DIEMEN'S LAND IN 1642; WITH NOTES ON THE LOCALITIES MENTIONED IN TASMAN'S JOURNAL OF THE VOYAGE.

By James Backhouse Walker.

Abel Janszoon Tasman was unquestionably one of the greatest, if not the greatest, of the navigators between Magellan, who in the early years of the 16th century first crossed the Pacific Ocean, and Cook, who in the latter years of the 18th practically opened Oceania and Australia to Europe.

Little is known of Tasman's personal history, except that he was born about the year 1602, at Hoorn on the Zuyder Zee, a seaport which produced many another hardy navigator. Tasman has made familiar in our seas the name of one of these fellow townsmen, the Cornelis-zoon Schouten, who in 1616 doubled the Cape, afterwards called the Horn in honour of the birthplace of its discoverer.

That Tasman's merit has not received due recognition, and that his fame has not been as wide as his achievements deserved, is the fault of his own countrymen. In the 16th and 17th centuries the persistent policy of the Dutch was to conceal the discoveries of their navigators, and suppress their charts, for fear other nations should reap advantage from the knowledge and rival them in the eastern seas. In later times when this motive had lost its force, Tasman's countrymen were strangely indifferent to the honour which their great sailor had won for his native land. Of his second voyage in 1644–in which he explored the northern coast of Australia, and laid down with painstaking accuracy the shores of the Gulf of Carpentaria —we have to this day only meagre hints and the record contained in a sketch map. Of his more famous voyage to the Great Southland in 1642—in which he discovered Tasmania and New Zealand, and made a great step towards solving the vexed problem of the fancied Terra Australis—the journal remained unpublished for more than two centuries. It is true that a short abstract of this voyage was published in Holland late in the 17th century, and was shortly afterwards translated into English, and included in several collections of voyages made by English and French editors, and that Valentyn, in his great work on the Dutch

East Indies published in 1726, gave a more extended account, illustrated by copies of Tasman's maps and sketches. But the journal itself remained practically unknown until a copy of it and of the original sketches and charts was discovered in London in 1776 and purchased for half a guinea. This MS. afterwards came into the possession of Sir Joseph Banks, and he employed the Rev. C. G. Woide, a Dutch clergyman living in London, to make a translation of it. Thirty years later the substance of this translation was printed by Dr. Burney in his "History of Discovery in the South Sea," published in 1814. Woide's MS. is now in the British Museum, and a verbatim copy of the part relating to our island has lately been made by Mr. Bonwick for the Tasmanian Government. In Tasman's own country his original journal remained neglected for more than two centuries, until in the year 1860 it was printed *in extenso* at Amsterdam under the editorship of Mr. Jacob Swart.*

Tasman's expedition was probably the first systematic attempt made by the Dutch to explore the Great South Land. In the early years of the 17th century the Western Coast of Australia had been several times sighted by Dutch Captains. Ships, bound for the Dutch settlements at Batavia, had been driven to the southward by storms, and the resulting discoveries had, therefore, been to a large extent involuntary, or at least accidental. In the year 1642, however, the Governor-General, Anthony Van Diemen, and the Council of Netherlands-India, determined to despatch from Batavia a properly equipped expedition, having for its sole object the discovery of the Great Southern Continent. The instructions to the commander, prepared by their direction, have been preserved. They contain a detailed statement of all that was then known by the Dutch of the geography of those parts, and they prescribe the course that the ships were to pursue. The command of the expedition was entrusted to Tasman, then 40 years old, and the ship *Heemskirk* was assigned to him for the service, with the little fly-boat *Zeehan* as tender. Tasman sailed from Batavia on August 14; reached Mauritius (then a Dutch settlement) on September 5, and sailed thence for the South on October 5. He held a S.E. course until on November 6 he had reached 100deg. E. long. in lat. 49deg. S., without finding any signs of the supposed continent. A council of officers was held, and the chief pilot, Francis Jacobsen, advised that the course

* Journaal van de reis naar het onbekende Zuidland in den jare 1642, door Abel Jansz. Tasman; medegedeeld door Jacob Swart. Amsterdam, 1860.

should be altered, and that the ships should make for lat. 44deg. S. until 130deg. E. long. was reached, when, if no mainland was meet with, they should sail into 40deg. S. lat., and steer on that parallel until they reached 200deg. E. long. By this course he thought they would be sure to fall in with islands, and having so far solved the problem of the great southern continent, he advised that they should stand north for the Solomon Islands, whence they might shape their course for home. By the middle of November they came to the conclusion that they had passed the extreme limits of the supposed continent, but on the 24th of the month land was seen bearing east by north, distant 10 Dutch miles (40 miles English.) Unlike the invariable low sandy shore which former captains had described as characteristic of the Great Southland, the country before them was mountainous, and clothed with dark forest. Tasman says: "This is the furthest land in the South Sea we met with, and as it has not yet been known to any European we called it Anthony Van Diemen's Land, in honour of the Governor-General, our master, who sent us out to make discoveries. The islands round about, as many as were known to us, we named in honour of the Council of India." They skirted the newly-discovered land, and on December 1 came to an anchor in a bay on the east coast. On December 3 they weighed anchor and sailed north until they reached a point about St. Patrick's Head, from whence they stood away eastward to make new discoveries. After eight days they sighted land, which Tasman called Staten Land, thinking that it might be part of the Southern continent and joined to Staten Land, east of Tierra del Fuego. (When this supposition was shortly afterwards shown to be an error,* the name was changed to that of New Zealand.) After a fatal encounter with the Maoris, Tasman sailed along the west coast of New Zealand to Cape Maria Van Diemen, and thence took a north-east course, discovering Amsterdam and other islands, and after skirting the north coast of New Guinea, he returned to Batavia. In his second voyage in 1644, Tasman again sailed from Batavia and explored the west, north-west, and north coasts of Australia, the Gulf of Carpentaria, and the south coast of New Guinea. Thus in the two voyages, though he left the question of the existence of a southern continent still unsolved, he had made the first complete circumnavigation of Australia and New Guinea.

* By the voyage of Brouwer round Cape Horn in 1643.

We may now turn our attention to identifying the parts of the coast of our island which were sighted by Tasman. The difficulty is that his longitudes are very uncertain, and his latitudes, though less variable, do not agree with modern observations, being in general some 9 or 10 miles too southerly.* His longitudes are quite hopeless. Their uncertainty is shown by the fact that he makes a difference of 3 deg. 40 min. between the west coast and Frederick Henry Bay, while the true difference is only 2 deg. 48 min.—an error of 52, or nearly a degree in that short distance. Many of his positions are stated to have been estimated by reckoning, and we know that in those days the ascertainment of longitude by observation was always very uncertain.

It is generally stated that the first land sighted by Tasman was near Point Hibbs, and his little chart of Van Diemen's Land appears to favour this opinion, but an examination of his journal leads us to a different conclusion. From the entries in the journal it is evident that his position on November 24, when he first saw the land, is not laid down on the chart at all. The latitude entered for noon that day is 42 deg. 25 min. As the weather was clear this was probably the observed latitude, and making allowance for the usual error we may place it some miles more to the north, say 42 deg. 20 min. or 42 deg. 15 min. From noon he sailed four hours E. by N. before he sighted land bearing E. by N. 40 English miles distant. When evening fell some three hours later this course would have brought him to a latitude a little to the northward of Cape Sorell (42 deg. 12 min.) This position would agree very well with his description of the land as he saw it on that evening, and which he describes as "very high." "Towards evening we saw three high mountains to the E.S.E. and to the N.E. We also saw two mountains, but not so high as those to the southward."

Flinders in his circumnavigation of the island identified the two mountains to the N.E. as those named by him Heemskirk and Zeehan after Tasman's ships. They are visible at about 30 miles distance. Now with Heemskirk and Zeehan bearing N.E., at a distance of say 20 miles, Mount Sorell, the southern peaks of the West Coast Range, and the Frenchman's Cap, would be nearly E.S.E., while the centre of the West Coast Range

* This conclusion is reached by a comparison of the [illegible] shown on his chart for his anchorage on the east coast, for Maria Island, the Friars, and Maatsuyker Island. On the other hand he gives the latitude of the point where he approached close to shore as 42 deg. 30 min., the true latitude of Point Hibbs being 42 deg. 38 min.

seen over the low sandy foreshore north of Macquarie Harbour would fit Tasman's description of the very high land in front of him. If the land near Point Hibbs had been first sighted, Mount Heemskirk would have been at least 50 miles distant, and not visible. It is therefore probable that the first land seen by the Dutch navigator was the mountainous country to the north of Macquarie Harbour. Without further observations the point must remain doubtful, but when we get the much-needed and long-expected Admiralty survey of the West Coast it will doubtless be possible to fix precisely the spot of Tasman's landfall.

When the shades of evening fell over the strange shore they had just discovered it was deemed prudent to run out to sea during the night, and when morning broke the land was far distant. The breeze had died away, and it was noon before they had enough wind to run in again towards the shore. By 5 in the evening they were within 12 miles of the land, and they kept on their course until within one Dutch mile (4 English miles) of what was without doubt Point Hibbs.

This was the opinion of Flinders, than whom there could be no higher authority on such a question, and Tasman's sketch, rough as it is, seems conclusive. Point Hibbs is there laid down as an island, but its distinctive form—unlike any point lying to the northward—is correctly shown.*

The ships stood out to sea again and sailed south-east in thick, foggy weather, in which only glimpses of the coast were obtained. Tasman took some of the high headlands and mountains about Port Davey for islands, calling them De Witt and Sweers Islands. Then he rounded the South West Cape, and named the Maatsuyker Islands, passing close to a small island about 12 miles from the mainland which looked like a lion, and which was indentified afterwards by Flinders as the rock named by Furneaux the Mewstone. Thence he passed between the mainland and a rock which he named Pedra Brancat (White Rock) from its resemblance to Pedra

* The only difficulty in reconciling the positions of the two days (Nov. 24 and 25) lies in the fact that the difference of latitude given in the journal is 5 min. only. The difference of latitude between Cape Sorell, where we suppose him to have been on the first evening, and Point Hibbs, where he certainly was on the second, is 26 miles. The discrepancy may, however, be accounted for. On the second day they had only very hard and thick weather, and probably got no observation. They had been standing off and on for 24 hours, and currents unknown to them would probably lead to error in estimating their position. The probability of error in Tasman's latitude is increased by the fact that he makes the latitude 42 deg. 30 min. instead of 42 deg. 38 min., the error being too northerly instead of too southerly, as usual.

† Known to our fishermen as "Peter's Bank."

Branca off the coast of China, and sailed past the entrance of D'Entrecasteaux Channel without entering it, though in his chart he marks an opening in the coast. Rounding the Friars (which he called Boreels Isles) on November 29 he bore up for a large bay, intending to anchor there. When he had almost reached his intended anchorage* a heavy storm arose, and he was driven out so far to sea that next morning he could hardly discern the land. It was from this incident that Storm Bay got its name. When the wind moderated he continued his easterly course, and rounding Tasman's Island (the Pillar) he turned northward along the east coast of Tasman's and Forestier's Peninsulas until, on December 1, an hour after sunset, he came to an anchor in a good port in 22 fathoms, the bottom fine, light-grey sand. "Wherefore," says Tasman piously, "we ought to lift up thankful hearts to Almighty God." The position of this anchorage, as shown in Tasman's chart, is north-west of the rocky islet now called Green Island, just north of the basaltic cliffs of Cape Frederick Henry.

On December 2, early in the morning, the boat was sent to explore, and entered a bay a good 4 miles to the north west (Blackman's Bay). The boat was absent all day, and returned in the evening with a quantity of green stuff which was found fit to cook for vegetables. The crew reported that they had rowed some miles after passing through the entrance to the bay (now known as the Narrows). They had heard human voices, and a sound like a trumpet or small gong (probably a cooey), but had seen no one. They saw trees from 12 to 15 feet round, and 60 to 65 feet up to the first branch. In the bark of these trees steps had been hacked with a flint for the purpose of climbing to the birds' nests. From the steps being five feet apart they inferred that the natives were either very tall†, or had some unknown method of climbing. The forest was thin and unencumbered by scrub, and many of the tree trunks were deeply burnt by fire. In the bay were great numbers of gulls, ducks, and geese. At various times during the day both the boats' crews and the people on board the ships had seen smoke rising from different points on shore, "so that without doubt in this place must be men, and these of uncommon height."

* The anchorage he aimed at was the same where Furneaux anchored in 1773, and which he named Adventure Bay.

† The early navigators had a fixed idea that these southern lands were inhabited by giants. At the Three Kings, north of New Zealand, Tasman describes the men they saw walking on the shore as being of gigantic stature.

The next day (Dec. 3) the boats went to the south-east corner of the bay in which the ships were anchored, in order to get fresh water, but, though they found a lagoon, the shore was so low that the waves had broken through, and the water was too brackish for use. The wind blew strongly from the east and south-east, and in the afternoon, when they again tried to effect a landing with the boats, the sea ran so high that one boat was obliged to return to the ship. The other larger boat, under the command of Tasman himself, made for a little bay to the W.S.W. of the ships, but the sea was too rough to allow of landing. The carpenter, Peter Jacobsen, volunteered to swim ashore with a pole on which was the Prince's flag. He planted the flag-pole in the ground on the shore of the bay, and thus Tasman took possession of our island for the Dutch.

Next morning at daybreak (Dec. 4), the storm having subsided, and the wind blowing off shore, they weighed anchor and stood to the northward, passing Maria Island and Schouten Island, so named by Tasman after his fellow-townsman of the good port of Hoorn.

On the following morning (Dec. 5) he took his departure from a high round mountain (St. Patrick's Head) and stood away to the eastward to make fresh discoveries.

Of the localities associated with the discovery of this island, the one round which the chief interest centres is Frederick Henry Bay and its neighbourhood. The name has been dislocated from its rightful position on the map, and has been transferred to another part of the coast, where it is now fixed by long usage. Tasman never saw what is now popularly known as Frederick Henry Bay. The bay to which he gave the name of the Stadtholder of Holland was in the immediate vicinity of his anchorage on the north-east coast of Forestier's Peninsula. Its exact locality the records of the voyage leave a little doubtful. The journal contains no names of places, but the account of the planting of the flag would lead to the inference that he gave the Prince's* name to the bay in which his ships lay at anchor, on the shore of which the Prince's flag was set up, and which is now known as Marion Bay. The charts, however, lead rather to the conclusion that it is the inner port or arm of the sea (now Blackman's Bay) which is the true Bay of Frederik Hendrik. The copy of the map in Burney leaves the

* Prince Frederik Hendrik of Orange was Stadtholder of Holland from 1625 to 1647. He was the grandfather of William of Orange, afterwards William III. of England.

point doubtful, the name being written on the land between the two ports. But in the chart as reproduced by Vallentyn, and stated to have been copied by him from the original journal, the name is distinctly written in Blackman's Bay. On the whole, therefore, it seems probable that this is the Frederik Hendrik Bay of Tasman.

The eastern shore of Forestier's Peninsula is wild and rugged, and scarcely known except to the hardy fishermen who, in their trips northward along the coast, fish in its quiet nooks, or run for shelter into the beautiful inlet of Wilmot Harbour. With the exception of a solitary shepherd's dwelling on the shore of this harbour—locally known as Lagoon Bay—the eastern part of the Peninsula is uninhabited, and so difficult of access that it is seldom visited. In the early part of 1889 I had an opportunity of thoroughly exploring a locality which must always be of interest as the spot where the sailors of the great Dutchman first set foot on the island which bears his name.

Our party—which included my friend Mr. R. M. Johnston—left East Bay Neck in a fishing-boat to camp at Chinaman's Point just within "The Narrows," or entrance of Blackman's Bay. During the time of our ten days' camping we cruised in our boat over the great bay outside, seeing the coast from the point of view which Tasman occupied when the *Heemskerk* lay at anchor off rocky little Green Island. We could thus realise the scene, unaltered after two centuries and a half, which presented itself to the old navigator when he caught his first near view of the picturesque shores of this outpost of the Great South Land, the mysterious continent of his search. To the south stood the jutting basaltic columns of Cape Frederick Henry—a lesser Cape Raoul—backed by the high round of Humper's Bluff. Thence his eye travelled northward round twenty miles of curving shore, its white beaches broken here and there by dark cliffs and rocky points. On the north, beyond the long stretch of white sand barring Blackman's Bay, rose steep-wooded hills, buttressed at their eastern end by the abrupt mass of Cape Bernier, thrusting its almost precipitous slope into the ocean, and flanked by the hills of Maria Island, shutting in the great bay on the north-east. The coast view from the offing is fine, but if the visitor wishes to appreciate fully the picturesqueness of the shore, and to identify the spots mentioned in the quaint old Dutch journal, he must be prepared for some rough scrambling on the Peninsula

itself. The country inland is poor, almost without water, covered with thin gum forest, scrub, and meagre grass. It is only the shore that is interesting. The rocky headlands, cliffs, and islands, against which the ocean dashes, are rent and scarred by sudden fissures and chasms, into which the waves rush roaring and tumbling. Between the points lie a variety of lovely bays; now a broad white beach with long rollers of breaking surf, now a rocky nook, now a quiet and sheltered cove.

Our centre of observation was the camping ground within The Narrows, from whence we looked out over the broad expanse of Blackman's Bay. This extensive inlet or arm of the sea is shallow and full of shoals and sandbanks, which make the navigation even of a boat dangerous to the inexperienced. It is shut in from the sea by a long tongue of land and by shoals, leaving only a small outlet very appropriately called "The Narrows," through which the tide rushes with great force. Early on the first morning after the ships had come to an anchor the two boats, under the command of Pilot Francis Jacobszoon, rowed through this narrow inlet to explore the new-found country. The pilot's description of the watering places where the water trickled so slowly that they could with difficulty fill a bowl is thoroughly characteristic of the eastern shores of Blackman's Bay. In the evening Pilot Jacobszoon returned on board with his collection of strange vegetables, and his report of the well-wooded country, the great trees scarred by fire, with marks on their bark of the steps of gigantic climbers, whom they had not seen, but whose mysterious voices they had heard.

The various localities mentioned in Tasman's journal were easily reached from our camp. Outside "The Narrows" the shore rises in high cliffs, at the foot of which a broad rocky shelf affords access to little nooks, which, in the early days of the colony, were the sites of stations for bay whaling, and are still known as Gardiner's and Watson's Fisheries. Some two miles from The Narrows is Cape Paul Lamanon. A fishing excursion to the neighbourhood gave me an opportunity of landing on the Cape. It is a low point, the soil of which is stony and arid, covered with small timber and rough scrub. From the Cape a short walk took me to the little cove marked on the maps as Prince of Wales Bay. It was on the shore of this little cove (cleene bochtien), situated to the west-south-west of Tasman's anchorage, that the Dutch flag was planted two centuries and a half ago. The shores of the bay on each side of the entrance

are rocky and broken, but further in the rocks give place to a beach of large grey shingle. As you advance along the shore up the bay the banks of shingle on each side curve into two horns shelving out towards the centre of the bay, and forming a bar extending nearly the whole way across the entrance to the inner cove. Within the bar of shingle lies enclosed a lovely cove, its quiet waters fringed by a curved beach of great smooth stones. On either hand it is shut in by steep banks crowned with dark forest, and from the steep grey beach at the bottom of the cove a wooded valley runs inland. Standing just outside the shingle bar at the entrance to this inner harbour it needs no great effort of the imagination to call up the scene on that 3rd December, 1642. Away out in the offing, near yonder grotesquely shaped Green Island, the high-pooped old Dutch ships lie at anchor. The wind is blowing fresh from the eastward, and two boats put off from the ships and stand for the shore. The wind increases to half a gale, and while the smaller boat runs back to the ships the larger boat changes her course and heads for this bay. As she approaches we can see on board of her Tasman himself, and some of the *Heemskerk's* officers; Gerrit Janszoon, the master; Abraham Coomans, the supercargo; and Peter Jacobszoon, the carpenter. The surf breaks violently on the shingle, and Tasman finds that to land in such a sea is impossible without great danger of wrecking the boat. Must he, then, after all, sail away without taking formal possession of the newly-discovered land? There is a short deliberation as the rowers rest on their oars, and then the carpenter, Jacobszoon, hastily throws off his clothes, plunges into the sea, and, pushing his flag-pole before him, strikes out for the shore. Making his way through the breaking surf he lands on the shingle beach, and there, at the foot of the steep slope, where four stately gums stand in a crescent on the hill side, he plants the flag of the Prince Stadtholder. We can imagine the cheer which greeted the raising of the flag as the carpenter, in the name of the States-General, thus took possession of the new territory of the Great South Land. Then the boat is brought as close in to the shore as possible, the carpenter swims out to her again through the surf, and they return on board the *Heemskerk*. "Leaving the flag," says Tasman, "as a memento to posterity and to the inhabitants of the country, who, though they did not show themselves, we thought were not far off, carefully watching the proceedings of the invaders of their territory."

Another place of interest on this coast to which we paid a visit is Wilmot Harbour, locally known as Lagoon Bay, a deep cove to the south of the basaltic promontory of Cape Frederick Henry. Here is the one solitary dwelling on this part of the Peninsula. It is probably the only locality which has altered much in appearance since the time of Tasman. Everywhere else the wild bush remains untouched, but here is green pasture, and even a small cornfield or two. The southern headland of the harbour is one of the wildest and most picturesque of spots. Standing on the grassy surface of its narrow extremity, which is rent into chasms and fissures, you look down upon the sea breaking tumultuously into a deep gulf below. On the other side of the gulf, to the south, there rises abruptly out of the water the grassy and wooded steep of a headland, with bold outline like Mount Direction. Turning to the north you see at your feet two rocky islands, their precipices crowned with wood and scrub, the waves heaving and swirling round their bases. Across the mouth of the harbour stand the basaltic columns of Cape Frederick Henry—a lesser Cape Raoul. Beyond, over outlying rocks and islets, is the place of Tasman's anchorage; while in the distance, twelve or fifteen miles off across the sea, loom the peaks of Maria Island.

On our return we took the way of the Two Mile Beach (the North Bay of the maps). Behind the sandhills at the back of the beach lies a large lagoon, which discharges its brackish waters by a narrow sandy channel at the south corner of the beach. This is the spot where Tasman's boat's crew landed—on the morning after their exploration of Blackman's Bay—to search for water, and where they found that the sea breaking through into the lagoon had made the water too brackish for use. The spot is easily identified from Tasman's description, and is probably hardly altered in appearance by the lapse of two centuries and a half. The beach is a fine stretch of broad white sand two miles long, on which the great ocean rollers break splendidly, and is backed by a line of low sandhills, behind which lies the lagoon.

For more than a century after Tasman anchored off Green Island no navigator ventured to follow him into the stormy seas that wash the dark cliffs of the Great South Land. The first of the moderns who sighted the coast of Van Diemen's Land was the French captain Marion du Fresne in 1772. Marion made the West Coast a little to the south of Tasman's landfall, and, following almost the same course as the earlier navigator,

his ships, the *Mascarin* and *Marquis de Castries*, on the 5th March, 1772, anchored at a spot somewhat to the north-west of the *Heemskerk's* anchorage in 1642. Marion took this to be the Frederick Henry Bay of Tasmania, but, as we have already seen, this was almost certainly an error, and since the visit of the *Mascarin* the outer bay, as distinguished from the inner, has borne on the charts the more appropriate designation of Marion Bay. The description in the narrative of the voyage* is not sufficiently exact to enable us to determine the precise spot where the French landed, but it appears to have been on the Two Mile Beach (North Bay of our present maps). On this beach it was that the aborigines of Tasmania first came into contact with Europeans. The meeting was an ill-omened one. The blacks resisted the landing, and attacked Marion's party with stones and spears. The French, in retaliation, fired upon them, killing one man and wounding others. The ships lay at anchor in the bay for six days, during which the French explored the country for a considerable distance, searching for fresh water and timber for spars, but they saw nothing more of the natives after this first fatal encounter. Being unable to find either good water or timber suitable for his needs, Marion sailed on March 10 for New Zealand, where he met his death in a treacherous attack on his people by the Maoris.

The next navigator who visited the Tasmanian coast was Captain Tobias Furneaux, Cook's second in command on his second voyage of discovery. It is to Furneaux's blunders that the confusion respecting Frederick Henry Bay is due. The two ships, the *Resolution* and the *Adventure*, were separated by a storm in latitude 50° south, between the Cape and Australia. Cook, in the *Resolution*, kept on his course for New Zealand; Furneaux, in the *Adventure*, being short of water, bore up for the land laid down by Tasman as Van Diemen's Land. On March 9, 1773, Furneaux sighted the land at a point which he took to be Tasman's South Cape. The point was, in fact, South West Cape, and from this initial error the whole course of subsequent blunders arose. From South West Cape he sailed eastward intending to make Tasman's anchorage in Frederick Henry Bay. Reaching the South Cape, he mistook it for the Boreel Islands, south of Bruny, and mistook the

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* Nouveau voyage à la mer du Sud, commencé sous les auspices de M. Marion [illegible] Capitaine de vaisseau [illegible] de M. C[illegible] Paris, 178[illegible]. Through the exertions of Mr. McCaymont and Mr. A. Mault, Marion's charts of Van Diemen's Land have been discovered in Paris, and *fac similes* of them obtained. See the Society's Papers and Proceedings for 1889.

entrance of D'Entrecasteaux Channel for Tasman's Storm Bay. The south point of Bruny he mistook for Tasman's Island (the Pillar), and called it Tasman's Head. Rounding Bruny Island he stood north, under the impression that he was sailing along the east coast of Van Diemen's Land, and in the evening came to an anchor in a bay of which he says—"We at first took this bay to be that which Tasman called Frederick Henry Bay, but afterwards found that his is laid down five leagues to the northward of this." Furneaux named his anchorage Adventure Bay, the point to the north he called Cape Frederick Henry—believing that Tasman's Frederick Henry Bay lay to the north of this cape—and the opposite shore of Tasman's Peninsula he laid down on his chart as Maria's Isles. After five days' stay in Adventure Bay, he sailed out and rounded the Pillar, under the impression that he was rounding the south point of Maria Island. Thence he proceeded north as far as the Furneaux Group, and then bore away for New Zealand to rejoin Cook.

Cook, on his third voyage, cast anchor in Adventure Bay on January 24, 1777, without detecting Furneaux's mistake or correcting his charts.

In 1789, Captain J. H. Cox, in the brig *Mercury*, anchored in the strait between Maria Island and the mainland, but, misled by the charts of Furneaux and Cook, never suspected that he was within a few miles of Tasman's Frederick Henry Bay.

In April, 1792, Admiral D'Entrecasteaux, with the ships *Recherche* and *Esperance*, sighted the Mewstone and bore up for the mainland, intending to make Cook's anchorage in Adventure Bay. Through an error of his pilot, instead of rounding Bruny Island, he stood to the west of it, and found that he was not in Adventure Bay, but in the entrance of the Channel, which he (like Cook) believed to be the Storm Bay of Tasman. D'Entrecasteaux explored the channel which bears his name, ascended our river, which he named Rivière du Nord, and explored the wide bay to the north-east, which he named Baie du Nord. This bay he thought, communicated with Tasman's Frederick Henry Bay on the east coast, and under this impression the land which Cook had erroneously laid down as Maria Island he named Ile d'Abel Tasman.

In 1794, Capt. John Hayes, in the ships *Duke of Clarence* and *Duchess*, visited Storm Bay—although the name does not appear on his charts.* He evidently had

* See Mr. A. Mault's paper, with *fac simile* of Hay's chart, in the Society's Papers and Proceedings for 1889.

only Cook's chart, since he places Adventure Bay, Tasman's Head, and Maria's Iles as they are laid down by Cook. Capt. Hayes re-named all the other localities in Storm Bay, and it is to him that we owe the name of the River Derwent. The Baie du Nord of D'Entrecasteaux he called Henshaw's Bay.

In December, 1798, Flinders and Bass, in their first circumnavigation of the Island in the *Norfolk*, sailed up Storm Bay and explored and surveyed the Baie du Nord of D'Entrecasteaux. Flinders says that he was at the time quite ignorant that this bay had ever been entered before, and, misled by the errors of Furneaux and Cook, he laid it down on his first sketch chart* as Frederick Henry Bay.

In January, 1802, the French discovery expedition under Admiral Baudin, in the ships *Géographe* and *Naturaliste*, arrived in D'Entrecasteaux Channel. During a stay of some weeks they completed the surveys of Admiral D'Entrecasteaux, and explored and surveyed the Baie du Nord. They then sailed for the east coast and anchored their ships in the passage between Maria Island and the mainland. From this point Freycinet, Baudin's lieutenant, made the first thorough examination of Tasman's Frederik Hendrik Bay. He explored it as far as East Bay Neck, and was thus enabled to correct the mistakes of former navigators. He found that D'Entrecasteaux had been mistaken in supposing that there was a channel between Frederick Henry Bay and the Baie du Nord, and that the supposed Ile d'Abel Tasman was a double peninsula, to which he gave the names of Forrestier's and Tasman's Peninsula (Presqu'ile d'Abel Tasman). He also proved that Flinders† had been in error in applying the name Frederick Henry to the Baie du Nord. The charts of Baudin's expedition, constructed by Faure, were the first to show this coast accurately: in them for the first time the outer port was laid down as Baie Marion, and the inner one as Baie Frédérick Hendrick.

Many years later, after his liberation from his long Mauritius captivity, Flinders came to write his "Voyage to Terra Australis." He had then had the opportunity of comparing his own surveys of fifteen years before with the French charts, and correcting his errors. In his atlas, therefore, the Baie du Nord is correctly named

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* See Mr. Mault's paper and *fac simile* of chart, cited above.

† Peron's narrative of Baudin's voyage was published in 1807. The author had, therefore, the opportunity of comparing Flinders' charts which were seized at the Mauritius in 1803.

North Bay, and the name of Frederick Henry Bay is restored to its proper place on the east coast; though Flinders applies it to the outer port and not to the inner which bears the name on Tasman's map.

The original error of Furneaux, perpetuated as it was by the high authority of Cook and of Flinders' first chart, had obtained too firm a hold to be displaced. On all the early English charts the Baie du Nord was laid down as Frederick Henry Bay, and by this name it is alluded to in all the early records; in Collins' despatches;* in Knopwood's diary;† as such it continued to be known to the early settlers, and so it is universally known to the present day.

After the publication of Flinders' atlas some of the early map-makers endeavoured to restore the names to their proper localities. Thus in a chart of Van Diemen's Land compiled by G. W. Evans, Surveyor-General, and published in London in 1821, and also in a chart published in London by Cross in 1826, North Bay is correctly placed, and the name Frederick Henry is in the first map applied to the outer bay, and in the second more correctly to the inner one. In Assistant Surveyor-General Scott's map published in Hobart by Ross in 1830, the name Frederick Henry appears in North Bay, but in Arrowsmith's map published in London in 1842, the alternative names are given, viz.:—Frederick Henry Bay *or* North Bay; while the name Frederick Henry also appears correctly in the inner bay to which it was originally applied by Tasman. In all modern maps, however, D'Entrecasteaux' name of North Bay has been most inappropriately transferred to what I have described as the Two Mile Beach, on the east coast of Forestier's Peninsula.

The Fredrik Hendrik Bay of Tasman is now known as Blackman's Bay. On early maps the name of Blackman's Bay is applied sometimes to the Two Mile Beach, and sometimes to Wilmot Harbour. By what freak of the map-makers of our Survey Department these names have been shuffled about so oddly I am quite at a loss to imagine.

The names as they stand are perhaps now too firmly established to be changed at once. But I would venture to offer to the Lands Office two suggestions:—

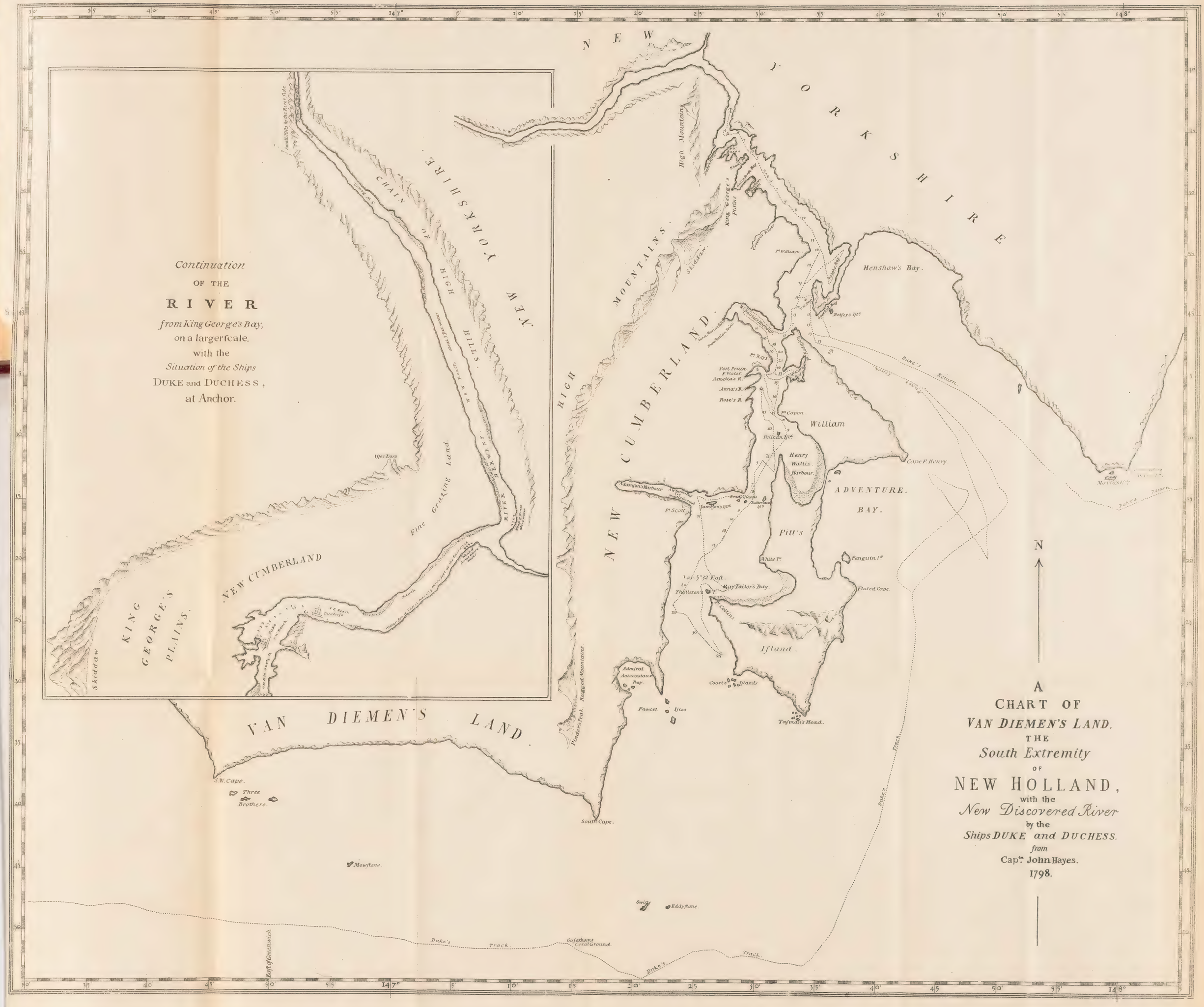
(1) As there is already a Cape Frederick Henry on the east coast of Forestier's Peninsula, which rightly marks Tasman's anchorage, a more appropriate name

* King to Collins, January 8, 1805; Collins to King, June 24, 1805
† Knopwood's diary, February 12, 180[illegible]

should be given to the other Cape Frederick Henry, forming the north point of Adventure Bay on Bruny Island. Let the last-mentioned Cape bear the name of its discoverer, and be rechristened "Cape Furneaux." This would remove one source of misapprehension.

(2) Though it may not be possible at once to restore the correct names of the bays, yet they may be indicated without causing confusion, and indeed with distinct advantage to the popular apprehension of our history. In all future maps let the names originally given be added in brackets. D'Entrecasteaux Baie du Nord would then appear as "Frederick Henry Bay *or* North Bay," and in Blackman's Bay would also be added "Fredrik Hendrik's Bay of Tasman."

Thus to perpetuate the remembrance of the landing-place of Tasman would be a graceful act of justice to the memory of the great seaman who, two centuries and a half ago, first circumnavigated Australia, and has given his illustrious name to this fair island of Tasmania.



Continuation
OF THE
RIVER
from King George's Bay,
on a larger scale.
with the
Situation of the Ships
DUKE and DUCHESS,
at Anchor.
NEW YORKSHIRE
CHAIN OF HIGH HILLS.
NEW CUMBERLAND
KING GEORGE'S PLAINS.
Skiddaw
Fine Grazing Land.
RIVER DERWENT
NEW YORKSHIRE
High Mountains
King George's Plains
Skiddaw
HIGH MOUNTAINS
NEW CUMBERLAND.
Henshaw's Bay.
Duke's Return
William
Henry Wallis Harbour.
Cape F. Henry.
ADVENTURE. BAY.
Pitt's
Penguin Id.
Fluted Cape.
Ray Tailor's Bay.
Thistleton's
Island.
Court's Islands
Tasman's Head.
Admiral Antecastaux Bay.
Fawcet Isles
Pinder's Peak. Rugged Mountains.
VAN DIEMEN'S LAND.
S.W. Cape.
Three Brothers.
South Cape.
Mewstone.
Swilly
Eddystone.
Duke's Track.
Duke's Track.
Duke's Track.
East of Greenwich
Goshathoms Coral Ground.
N
A
CHART OF
VAN DIEMEN'S LAND,
THE
South Extremity
OF
NEW HOLLAND,
with the
New Discovered River
by the
Ships DUKE and DUCHESS.
from
Capt. John Hayes.
1798.

REPORT

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1890.

Tasmania:

WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1891.

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*Members who next retire in rotation.

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* Members who have contributed Papers which have been published in the Society's Transactions.

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* Fellows who have contributed Papers which have been published in the Society's Transactions. † Denotes Life Membership.

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Barclay, D.
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* Barnard, C.E., M.D., F.L.S.
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Davies, Charles Ellis.
Davies, J., Beaconsfield.
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Dobson, Hon. Alfred, M.H.A.
Dobson, Henry.
Dobson, His Honor Sir Lambert, F.L.S.
Downie, J. H.
Dicker, Rev. Canon, Hamilton.
Duffy, W.
Dundas, Very Rev. Chas. Leslie.

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Elliston, C. H.
Evans, T. M.

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Gosnell, A. W., M.A.
Grant, C. H.
Guesdon, Chas.

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Hardy, Dr.
Hales, Robert Shirley.
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Huybers, James Alfred.

Innes, J. H.

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Jacobs, Edwin.
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Knight, William J., M.A.

* Legge, W. V., Colonel, R.A.
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Lodder, Miss Mary, Lonah, Leven, N.W. Coast.

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Macfarlane, John.
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Mather, J. B.
* Mault, Alfred.
Maxwell, C. M.
Maxwell, J. Crawford.
Milles, R., Sydney.
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Shaw, Bernard.
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Shoobridge, R. W. G., New Norfolk.
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* Swan, Edward D.
Syme, J. Wemyss.

Tabart, T. A.
Taylor, A. J.
* Thureau, G., F.G.S., Launceston.
Thompson, Rev. E. H. T., Huon.
Toplis, W. J.
Tottenham, Major-General.

Turnbull, T.
Triffit, J. T., Ouse.
* Travers, S. Smith.

Walch, Chas. E.
Walch, James H. B.
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Wallack, E.
* Ward, W. F.
Waterhouse, George Wilson, B.A., Launceston.
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Wilson, Edward P.
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* Woollnough, Rev. J. B. Williams, M.A.
Wright, Howard.

Young, Russell.
Young, F. J., B.A.
Young, F.M.

MINUTES of the Annual General Meeting of the ROYAL SOCIETY OF TASMANIA, *held at the Museum on Friday evening, 12th March,* 1891,—*Mr.* JAMES BARNARD, *Vice-President, in the Chair.*

NEW MEMBERS.

Mr. J. J. Walker, R.N., Chief Engineer of the *Penguin*, was elected a Corresponding Member.

Captain P. R. H. Parker, R.N., and Messrs. E. Watchorn, John Brown, and Montague Jones were elected Fellows.

THE ANNUAL REPORT.

The Secretary (Mr. A. Morton) read the Annual Report.

Sir Lambert Dobson moved—That the Report now read be adopted, printed, and circulated among the Fellows of the Society. He said that the Report really spoke for itself; but in the slight reference he would make to it he would like to say one word in reference to the great interest taken in the progress of the Society by His Excellency the Governor. He thought that, in the absence of Sir Robert Hamilton, they might very fairly pay a tribute to the generous and warm interest he had taken in the Society. His Excellency had hardly ever failed to be present, and he had not only manifested a personal interest, but had given the Society, as a present, a very valuable work. They were also indebted to those gentlemen whose names appeared as having read papers at the meeting of the Society, their only regret being that they had not a larger number of contributors, and the work distributed over more shoulders. He thought that they had reason for congratulation at the progress of the Society, both numerically and financially, and he had no doubt but that much of that success was due to the Secretary. He mentioned that gentleman specially because he had worked hard, and done good work for the Society. He believed that there was much to be done in the walks of science here. A naturalist on board H.M.S. *Penguin* had discovered many species of new insects since the ship had been in the harbour, and doubtless many more might be discovered if there were in our midst those who followed such pursuits.

Mr. F. Jacobs seconded, and the motion was passed.

Mr. E. D. Swan moved—That the Hon. J. W. Agnew, M.D., His Honor Sir Lambert Dobson, Messrs. Russell Young, and C. H. Grant, the retiring Members of the Council,

be re-elected; also that Messrs. Francis Butler and John Macfarlane be re-elected as Annual Auditors.

Mr. F. Abbott seconded, and the motion was passed.

Mr. Francis Abbott moved—That a vote of thanks be accorded to Messrs. Butler and Macfarlane for their kindness in acting as Auditors during the year.

Mr. A. W. Gosnell seconded, and the motion was agreed to.

Mr. C. H. Grant moved—That a vote of thanks be accorded to the Press for their valuable services in publishing such full and accurate notes of the Society's proceedings.

Dr. Bingham Crowther seconded, and the motion was agreed to.

This finished the business.

REPORT.

THE Council of the Royal Society of Tasmania have much pleasure in submitting the following Report for 1890 :—

The first monthly meeting took place on April 22nd, when the President, His Excellency Sir R. G. C. Hamilton, K.C.B., occupied the chair. The attendance of Fellows, including several ladies, was large. Mr. James Barnard gave an account of the visit of the Representatives of this Society to the Melbourne meeting of the Australasian Association for the Advancement of Science. Mr. J. B. Walker read an interesting paper on the "Discovery and Occupation of Port Dalrymple." Mr. R. M. Johnston presented a joint report from himself and Mr. A. Morton on a ganoid fish from the lower mesozoic sandstones near Tinder Box Bay; and Mr. A. Durrand, F.R.M.S. London, exhibited a series of fine microscopical preparations of foraminifera and other minute organisms dredged from depths of from five fathoms to two miles, near the coasts of the Hawaian Group, Java, the Channel Islands, Ireland, &c. The number of papers read during the session was twenty-three. The subjects were :—

By Mr. J. B. Walker.

1. "The Discovery and Occupation of Port Dalrymple."
2. "An Account of the last Antarctic Expedition."
3. "Notes on the localities mentioned in the Journal of Tasman's discovery of Tasmania."

By Mr. R. M. Johnston, F.L.S.

4. "Description of a second Ganoid Fish from the mesozoic sandstones near Tinder Box Bay."

5. "Further observations upon the Fishes and Fishing Industries of Tasmania, together with a revised list of indigenous species."

6. "Root matters in Social and Economic Problems."

7. "Provisional aid to the study of the Tasmanian Mollusca."

8. "Notes on a Fern new to Tasmania *(Blechnum cartaligenum.)*"

9. "Observations on the influence of Strikes upon Real Wages."

10. "A rejoinder to Mr. A. J. Ogilvy's paper, entitled 'Can the toiling masses really improve their condition by Strikes?'"

By Mr. E. C. Nowell.

11. "Do the changes of the moon affect the rainfall?"

By Captain Shortt, R.N.

12. "A rejoinder to Mr. Nowell's paper."

By Mr. A. Morton, F.L.S.

13. "Notes on a recent dredging trip in the Derwent."

14. "What Science and Commerce may gain from an Antarctic Expedition."

15. "A complete list of Ferns found in Tasmania, with full descriptions of the genera and species."

By Mr. A. J. Taylor.

16. "On the coco-de-mer *(Lodoicea seychellarum)*."

17. "Notes on the Native Hop *(Daviesa latifolia)* as a cure for Hydatids."

By Wm. Montgomery, M.A., Government Geologist.

18. "Notes of some geological observations on the West Coast."

By Mr. A. T. Urquhart, Corresponding Member.

19. "Description of some new Tasmanian Spiders."

By Mr. James Andrew.

20. "Notes on Ostrich Farming."

By Mr. A. J. Ogilvy.

21. "Can the toiling masses really improve their condition by these incessant and unhappy Strikes, or are they only beating their hands against the iron bars of inexorable economic law ?"

By C. E. Barnard, M.D.

22. "Actinomycosis and Tuberculosis."

By Baron Mueller.

23. "Notes on a new Tasmanian plant of the order Burmanniaceæ."

It will thus appear that original work of a valuable character, especially in reference to the Natural History of Tasmania, has been done during the session ; and it is satisfactory to report that the annual volume will very soon be ready for distribution.

Council.

No change has taken place during the session.

Library.

The most noteworthy circumstance in connection with the Library has been the very liberal donation by His Excellency of the recent (9th) edition of the "Encyclopedia Britannica," 24 vols. Dr. Agnew also presented the Report of the scientific results of the voyage of H.M.S. *Challenger* during the years 1873–6, in three volumes.

Fellows.

Seventeen Fellows and two Corresponding Members have been elected ; nine have resigned.

Finance.

The income has been—Subscriptions to Royal Society, £189 ; fixed deposit, £323 8*s.* 9*d.*; interest, £5 15*s.* ; total, £518 3*s.* 9*d.* Expenditure, £244 2*s.* 9*d.*

STATEMENT of the Funds of the ROYAL SOCIETY *for the Year* 1890.

Receipts.	£	*s.*	*d.*
Fixed Deposits	323	8	9
Subscriptions	189	0	0
Fixed Deposit (Interest)	5	15	0
	£518	3	9

Expenditure.	£	*s.*	*d.*
Balance	37	9	0
Salary of Secretary	50	0	0
Ditto Attendant	6	0	0
Petty Cash	1	4	3
Printing, Stationery, and Periodicals	151	19	6
Interest due to Museum	15	8	9
Insurance	1	5	0
Cheque Book	0	8	4
Collector's Commission	7	10	0
Gas and Fuel	9	4	11
Legal Expenses	1	2	0
Balance per Bank Book £29 13 0			
Cheque paid into Bank 14th Jan., 1889 ..... 1 1 0			
	28	12	0
Fixed Deposit	208	0	0
	£518	3	9

Examined and found correct.

JOHN MACFARLANE.
FRANCIS BUTLER.

11*th March*, 1891.

STATEMENT of the Funds of the MORTON ALLPORT MEMORIAL FUND *for the Year* 1890.

1890. Dr.	£	*s.*	*d.*
Balance as per statement for 1890	50	5	9
Interest.....	17	15	7
	£68	1	4

Cr.	£	*s.*	*d.*
Balance in Savings Bank to credit of Fund	68	1	4
	£68	1	4

Examined with Savings Bank Book, and found to be correct.

JOHN MACFARLANE.
FRANCIS BUTLER.

11*th March*, 1891.

WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

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